THE EAST RIVER BRIDGE DISASTER.

The inquest in the case of the twelve persons who were killed on the Brooklyn Bridge in the crowd on Decoration Day was begun by Coroner Martin on the 4th. Superintendent C. C. Martin testified that after the military and police had left the bridge on the day of the opening, on Thursday, May 24, it was put in charge of the bridge police. On the following Saturday and Sunday, when there were very large crowds, these policemen still had control.

On Wednesday, the day of the disaster, the crowd was moving along regularly. Ten minutes before the accident he received a report that the promenade was well filled, but that there was no crowd or stoppage. This was about 4 o'clock. A few moments later he heard a tremendous rumbling and supposed it was a runaway. It proved to be a fire truck. He hurried up from the Brooklyn tower and went to the scene of the accident. By that time the bodies had been removed. He had heard two or three different accounts of the cause of the panic. The best one was that a woman fell on the bottom step and screamed. This caused the crowd to rush forward, and the idea arose that the bridge was falling or had pulled away from its anchorage. Mr. Martin continued:

There were twenty-two police on the bridge that day. I appoint the officers, and I have sole control of them. I have known some of the men for years. They have been employed on the bridge, and are men of good judgment who can be trusted to carry out instructions. All were not uniformed, for their uniforms are not ready yet. All had shields on their breasts. James Ward is the captain of the bridge police. He was formerly connected with the Brooklyn police, and resigned because he was reduced from sergeant to roundsman for a trivial mistake. He had had twelve years' experience as sergeant. The police have been on duty twelve hours at a time, but hereafter it will be only eight hours.

Since the accident a railing has been put in the middle of the steps, extending some twenty-five feet beyond. My judgment is that it will be of little use and no safeguard. On Friday I noticed that the southern half of the footpath was crowded full, while the other side was nearly vacant. In case of panic the railing would be one more point where people would be crushed. I think the stairs are right as they are. It would be possible to remove them and substitute an inclined plane. My judgment is that the steps are much safer than the slope would be. There would be a rise of ten feet to overcome. The rise is now 3½ to 100 feet in length. Even now the walk is slippery. With a greater rise it would be unsafe in icy weather. The safest step is an ordinary step, which people will descend naturally and without exertion. It is possible that a body of regular police might have been able to stop the panic at its beginning, but after its start they would have been carried along with it. The width of the pathway is 17 ft. 5 in. above and below the steps. It is 4 ft. narrower where the cables meet the promenade.

By a Juror—Would two rails not be better than one?

Mr. Martin—I do not think so. It would simply occupy space. As it is, a middle rail inconveniences people morning and night. It would not be possible to put a gateway and path to the roadway from a point on the promenade near the stairs, for the trains on the railroad would interfere. As to closing the gates at the time of the disaster, a sergeant of police told the gatekeeper to close them, but he did not do so until he was sure that something had happened. Then he closed them of his own accord. I was in the crush of the previous Saturday afternoon, and I ordered two sections of the fence to be removed, and this relieved the crowd by turning them on the roadway. On Friday afternoon, when the crowd was great, I used the roadway again. In doing this I felt I was taking a great risk in letting people upon the drives where teams were. There was danger of runaway teams and drunken drivers. When the trains are running the fence cannot be removed. The trustees provided for this yesterday by directing that in case of a crowd a south roadway shall be given up to foot passengers. There was no telegraphic communication between the ends of the bridge at the time of the accident, but there is at present.

A Juror—Mr. Martin talks of what should be done in case of a panic, but there should be no panic. The public should know just how much the bridge can bear, and thus judge of their safety.

Mr. Martin—If the utmost weight of vehicles and passengers that could be put on the bridge was doubled four times, the bridge would be in danger of breaking. Of course it is impossible to get that weight on. A line of wagons with five tons of brick each would not affect it. The promenade was intended to accommodate only 50,000 passengers a day; 163,000 a day is beyond its real capacity. To give up one roadway to pedestrians would greatly inconvenience the vehicles, which would then be unable to pass each other.

The Juror—I wished to bring out these facts and to convince the public that there is not the least danger of the bridge breaking down.

Mr. Martin—I think the only precautions against accident that can be taken are to keep the people moving and use the roadways when there is a crowd. There are two or three ways by which the accommodations for foot passengers can be increased. One is to floor over the railroad trestle work or extend beams out on the sides of the roadway, and thus make an outside pathway. I do not think it advisible, as I believe there will be ample room when the cars begin running. The pathway was raised above the level of the roadways to allow of braces being put beneath to stiffen the beams. I do not think it would be wise to have single steps at long distances apart. I believe the police force is efficient and adequate to prevent trouble unless there should be a panic. No man has been appointed by political pressure. There is no influence except their competency. In case of storm the stairs will be cleaned as soon as possible. Rubber mats will be placed on them in winter.

Trustee James S. T. Stranahan testified:

I have been a director and trustee of the bridge since the commencement of the work. The original plans always contemplated a railroad. I think the bridge is properly constructed. No one can say that this panic may not occur again. I remember that people were killed in a panic on Boston Common during a display of fireworks. I had various conversations with Commodore Vanderbilt concerning the uses of the bridge, but it was in regard to a sunken road. We expect when we start the cars that the relief will be complete. On extraordinary occasions we will give up one of the roadways to the foot passengers. We think the present police force is sufficient, or we should make changes. Our force is supplemented by the police forces of both cities working with us. Col. Roebling would prefer not to increase the weight on the center cables by putting walks over the railroads, but would rather extend footways on the sides, fastened to the outward trestles. The original gauge of the railroads was to be 6 feet, but was changed to 4 feet 8½ inches. It was never contemplated that an engine should cross the bridge. I have not the slightest idea that Mr. Corbin, of the Long Island road, has any pledge from any trustee. The only intention I have heard is that no one shall have exclusive privileges. The changed gauges was partly to accommodate the elevated roads.

William C. Kingsley, acting President of the Brooklyn Bridge Trustees, testified on the 5th that he was out of the city at the time of the disaster on the bridge, but returned at once when he heard of it, and took every means to inform himself about it. His conclusions were: There was a large crowd on the bridge, but fifty per cent. less than the crowd of some other days. A woman fell and screamed, and this frightened the people. Those behind were curious to know what had occurred, and in pushing forward they crowded others down the stairs. They fell over the woman, and were trampled on by those who followed. Detectives and bridge officers acted coolly and tried to stop the panic, but were unable at first to do so.

The trustees appointed Trustees Davis, Bush, Stranahan, Swan and the witness a committee to take charge of the bridge when it was opened. The committee selected Mr. C. C. Martin as Superintendent by unanimous vote, because he had the confidence of all. The committee suggested that he select officers so far as he could from among the old employés of the bridge, who had proved themselves faithful, courageous and trustworthy. There was a larger police force on the bridge at the time of the accident than any of the committee had ever thought necessary. Mr. Kingsley added:

We thought we were very liberal in allowing for 50,000 or 60,000 people a day. On the first Sunday 163,000 crossed. We increased the number of police, and thought it was ample. To have increased it further would have looked as if we were doing it for some secret reason. There was no limit as to the number of police. The superintendent could have employed more, but in his judgment, and in the judgment of others, the twenty-two men employed were sufficient. If we had had fifty-four policemen on the bridge the panic could not have been prevented.

I have seen riots, and am aware how a few sturdy brave men can control a mob, but men in a riot are not panic-stricken. They march up for some deliberate purpose. In a panic those who are panic-stricken become frenzied and crazed. The bravest police could not have beaten back the onset of a panic-stricken crowd. I am told that there was in the crush a large man who lost a hat and a shoe, and who ran across the park and into the police station and asked for protection. You cannot control people who are thus terrified.

This is only one bridge, and cannot do the work of two or three. If we were to build it over again we would probably make it more commodious, especially for foot passengers. We took the advice of those who had the most experience in such matters. Their plans seemed so reasonable that they were adopted. As to the necessity of the stairs, we were obliged to go to Congress for permission to build the bridge, and a committee was appointed by the Secretary of War to examine our plans. It made a long investigation, affirmed our plans, but recommended that we make the main span 135 feet above the river in the centre, instead of 130 feet as we had intended. The central pier of the towers obstructs the pathway and we are obliged to go around it. We are obliged to have a certain depth of truss in order to secure strength and stiffness. To avoid the central pier we are obliged to go over the railroad track. It was a question whether to run an inclined plane from the towers or to use stairways. It was thought best to have a more moderate grade and to build the stairs. Notwithstanding the accident, I still believe the stairs are preferable to the inclined plane. Their greater advantage will be seen in frosty weather, when the walk becomes slippery. Even now it is a steep grade.

It is possible to increase the width of the roadway for the accommodation of foot passengers, but I do not say it is desirable. It is a question for the engineers. As to the strength of the bridge, I assume there is no doubt or anxiety in the public mind on that point. The weight to-day without the road is 14,000 tons. The greatest weight when the promenade, roadway and railroad are crowded would be about 17,000 tons. The strength of the bridge in its weakest part is 64,000 tons. The weakest part is probably at the anchorage and not on the cables. I mention this because I heard that in the panic some one cried out that the bridge was giving way. That undoubtedly increased the panic.

Everything was ready and in perfect order for the opening on May 24. The telegraphic communications were not in order then. I did not hear that Mr. Roebling had urged that the bridge be not opened until the railroad was opened. I do not think it is true. Putting a shed over the pathway has been discussed. The shed would have to be left open at the sides or it could not resist a strong gale unless it was made heavier than would be desirable for the bridge to bear. An open shed would not protect people much in a gale.

A panic is liable to occur on the bridge, in Broadway, in an open field or anywhere at any time. The bridge ought to be made safe, but the determination whether it is safe and practicable to increase walking facilities requires time. If the question is settled in the affirmative they will be increased at once. We were accused of being over-extravagant in building too big a bridge.

Good policemen cannot control a panic. Dead weight will overcome pluck at any time. If the crowd becomes so great as not to be safe we can close the bridge until it clears itself, build other pathways, or use one of the roadways for foot passengers. It would delay the vehicles greatly to confine them to one road. It has already been done.

All the police, except recent appointments, have their uniforms. They have no drill, but the captain instructs them as to their duties. There is no standard as to the size of the policemen, but we try to get large, good-looking men. They get $2 a day. I think that pay will secure as good a class of men as higher pay.

Charles O'Connor, a detective sergeant of the New York police, testified:

I and two other detectives were 100 feet west of the stairs. We saw a man running toward us without a hat. We started to stop him, but saw what had occurred on the stairs. We went there and helped clear out the crowd, and picked up the wounded. I think ten policemen in uniform could have kept back the crowd and prevented the panic. We did not allow any pickpockets on the bridge. Six were arrested that day.

I don't think $2 a day is enough for a policeman. A man cannot live on it. I don't believe reliable men can be obtained for that money. They can do better than that outside.

J. B. Kirchoff, a lawyer, of 52 Sands street, Brooklyn, testified:

I was some distance above the stairway with two little children and a girl 14 years old. An officer came along and told us we must go along back to New York. This frightened every one, and I told the officer not to give that order, for it would kill us all, because it was impossible to push on to New York. I put the children on the railing and sat beside them. The pressure was terrible, and women and children screamed. Then a civilian and a policeman tried to turn the crowd back to Brooklyn. The policeman seemed to frighten the people. There was a sea of upturned faces coming from New York below the stairs. I should feel afraid to cross the bridge again. If the policeman had gone coolly and quietly about his work I believe there would have been no trouble.

In charging the jury, Coroner Martin said that many engineers and mechanics whom he had subpœnaed had not appeared. It was the duty of the jury to fix the blame. The testimony of Mr. Martin and others proved conclusively, in his

judgment, that the bridge was not ready to receive people. There was no telegraphic communication. The police force was inadequate and ununiformed. The pay was too small to secure good men.

Then the Coroner raised his voice, and said, excitedly:

The promenade is not wide enough. It ought to be twenty-five feet wide. There should be no railroad business. If the stairways remain there will be another calamity just as sure as there is a God in heaven. They have done nothing except put up an iron railing. The people of New York and Brooklyn should rise in arms and demand that the bridge be closed until it is ready to be opened.

Several people in the audience and some of the jurors applauded. The jury retired for an hour and returned the following verdict:

"We, the jury in the case of George Smith and eleven others who lost their lives on the New York and Brooklyn Bridge, on May 30, 1883, find that they came to their death through suffocation by being trampled upon. In view of the above fact, we find the trustees and officers reprehensible in not having the bridge and its approaches properly policed, and particularly at the steps. Had this important matter received the careful attention of the managers of the bridge to which it was entitled, the vast throng upon the structure would have been kept moving, and the panic resulting in the death of twelve persons would have been averted. The construction of this footway and steps is not of sufficient capacity for the accommodation of the foot passengers. The trustees should not pass this disaster over as a special dispensation, and not likely to be repeated, but give their serious attention to the problem of making this promenade absolutely safe.

PRESERVATION OF TIMBER.

Appreciating that the rapid destruction of the forests in this country, and the consequent advance in the price of timber, give increasing importance to its artificial preparation against decay, the American Society of Civil Engineers, some four years ago appointed a committee to report upon the "Preservation of Timber."

This committee has been pursuing its labors ever since. It has sent out some 2,000 circulars; corresponded with some 350 persons; examined 104 patents; gathered such reports, pamphlets and publications as it could obtain; and generally collected all the information it could concerning experience in preserving timber in this country and in Europe.

The specimens now exhibited at the Chicago Exposition of Railway Appliances have been gathered by the committee in the course of this investigation. They are shown in order to call attention to an important economy, which must soon be taken up by our railroads; and have been entered and arranged through the courtesy of the Western Society of Engineers of Chicago, which has kindly appointed a committee for this purpose.

The facts illustrated by these specimens may be briefly referred to:

Although almost innumerable methods of preserving timber have been tried, there are but few which have been successful. Of these there are at least three, which when well done can be relied upon to prolong the life of wood exposed to the elements. These are: Kyanizing, Burnettizing and Creosoting.

In Europe, these methods have passed beyond the domain of experiment. They there produce large economical results. In this country the principal obstacle to wood preservation has been the cheapness of timber. It did not pay to inject it, because to be effective, the work must be well done, and the cost of effecting this has hitherto added an undue proportion to the price of our cheap woods. It was cheaper to let them rot and to renew them.

This condition of affairs is fast being removed by the rapid enhancement in the price of timber, and the proximate exhaustion of our more available forests; so that the time has probably arrived when it is not only economical but necessary, in many parts of the country, to prepare wood to resist decay in exposed situations.

It is believed that the selection of the proper method to be used, in any particular case, depends upon the proposed subsequent exposure of the timber (dry, wet, marine worms, etc.), and on the amount which its value (unprepared) admits of being expended upon it.

KYANIZING.

This consists in steeping the timber in a solution of corrosive sublimate. Details concerning it will be found in the circular letter issued by Mr. J. B. Francis.

For bridge and trestle timber, for fences in dry soil, and generally for wood exposed to the weather, but not to constant moisture, kyanizing may be relied upon.

The specimens of timber here exhibited; some of hemlock, exposed for forty years at Fort Ontario, Oswego, New York, and others of various kinds of timber exposed for twenty years at Lowell, in a sandy soil, by Mr. Francis, illustrate this point; while the samples of spruce, from the gate-boxes of the Lowell Water-Works, exposed in various soils for ten years, exhibit the effect of various degrees of moisture, and show that kyanized timber should be kept dry.

Kyanizing costs about six dollars per thousand feet, board measure. Under favorable circumstances it may be relied on to double or quadruple the life of the more perishable woods. Where and when it will pay to use this method will depend upon the price of the timber and its subsequent exposure.

BURNETTIZING.

This consists in injecting the timber with a solution of chloride of zinc. It cannot be done successfully unless the wood is first seasoned, either naturally or artificially, to deprive it of moisture, and make room for the solution. This is forced in under pressure in closed cylinders, and is liable to wash out subsequently from the outer layers of the timber, unless retained in some way.

For cross-ties, and for timber exposed to weather and moisture, but not in very wet situations, burnettizing is probably, in view of the present price of timber, the most economical method to use. It costs, if well done, about five dollars per thousand feet, b. m., or some twenty to twenty-five cents a tie. It can be done for even less, but the result is not likely to be satisfactory.

The hemlock and maple ties exhibited, which have been in use fifteen years on the Lehigh & Susquehanna Railroad, and the oak tie, seventeen years in use on the Erie Railway, show the results which may be accomplished. In Germany burnettized fir and beech ties average fifteen to eighteen years in the track, and this method has there become the favorite for ties, after extensive trial of all the others.

This process should by preference be applied to the cheaper and more open-grained woods. It does not answer so well for bridge ties and timber, as burnettized timber is apt to check and split when dry and exposed to the sun.

It will probably not pay to burnettize ties where white oak or other equally durable woods can be obtained at forty or forty-five cents a tie, but a recent investigation upon one of the eastern trunk lines, about 1,000 miles long, has indicated the expectation that with white oak ties at sixty-two cents each, and hemlock ties at twenty-eight cents each, an annual economy of $250,000 may be expected by burnettizing the hemlock, instead of laying down the oak unprepared.

CREOSOTING.

This consists in injecting the timber with hot creosote oil under pressure. The mode of application and necessity for seasoning are much the same as for burnettizing.

For timber in very wet situations, or exposed to marine worms, the best method to use is that of creosoting. It is the most effective, but also the most costly of the various processes.

When well done, it costs from $12 to $20 per thousand ft. b. m., or about 50 to 60 cents a tie. It is the favorite method used in England, and is there materially cheaper than here, in consequence of the lesser price of the oil.

The English ties exhibited have been twenty to twenty-two years in use, and show perfect preservation. Ties and timber creosoted in this country are also shown, but have not had so long an exposure. It is probable they would be thrown out of service, by being cut into by the rail, long before they would decay.

Creosote oil is the only effective preservative known against the Teredo Navalis. All other substances have failed. How much of the oil must be injected to prove sufficient, probably depends upon the exposure. The English engineers specify 10 or 12 lbs of oil per cubic foot. Some French engineers, and the American engineers who have had experience in the South, specify from 14 to 18 lbs. to the cubic foot, to be quite safe against the teredo. Each additional pound adds about $1.20 per 1,000 ft., b. m., to the cost.

Where it will pay to use this process depends upon a number of local circumstances and prices, which cannot well be enumerated here. It is very good but costly.

There are other substances, such as pyrolignite of iron and sulphate of copper, which have proved fairly effective in preserving timber, but European experience seems to favor most burnettizing and creosoting.

The sections of ties here exhibited, as from the Wabash Line, and from that of the New York, Pennsylvania & Ohio, were prepared by a modification of the sulphate of copper process.

The original patents on all the effective processes have long since expired. There are several patented modifications and modes of application, some valuable and some otherwise, which are still in force. Whether it will pay to use them, each railroad will decide for itself. As a rule other methods than those which have been mentioned are either less effective or are untried experiments.

It cannot be too strongly insisted upon that to be effective the work must be well done. The sap or moisture must be got out of the timber, and a sufficient amount of antiseptic be put in. If the solution exceeds a certain strength, the wood is rendered brittle and inelastic, so that both skill and honesty are required to accomplish success.

As an inspection subsequent to the doing of the work does not establish the fact whether it has been well done, the safe course for those who may decide to have some timber preserved is either:

1. To do the work themselves.

2. To contract it at a sufficient price to reliable parties, keeping an inspector at the works to note the daily working, when the magnitude of the order will warrant it, or

3. To contract the work on such terms that the profits shall depend upon the results accomplished in preserving the wood against decay.

As the Committee of Engineers is still pursuing its investigations, and is endeavoring to account for some anomalies which have come to its notice, it particularly desires to obtain the record of past experiments in this country (especially of failures) in order to ascertain whether the failure (or the success) was due to the preserving agent selected, to the quantity or strength of the solution injected or to the mode of applying it. Correspondence is therefore solicited, together with such copies of reports or pamphlets as may be accessible.

The Committee of the American Society of Civil Engineers on the "Preservation of Timber," is as follows:

It expects to make its final report this year.

O. CHANUTE, Chairman, New York.
E. R. ANDREWS, New York.
E. W. BOWDITCH, Boston.
G. BOUSCAREN, Cincinnati.
C. SHALER SMITH, St. Louis.
J. W. PUTNAM, New Orleans.
B. M. HARROD, New Orleans.
COL. G. H. MENDELL, San Francisco.

The following is the Committee of the Western Western Society of Engineers, which is in charge of the present exhibit at Chicago:

L. M. JOHNSON, Chairman, Chicago.
L. P. MOREHOUSE, Chicago.
G. A. M. LILJENCRANTZ, Chicago.

Please address all information, pamphlets, etc., to O. CHANUTE, Chairman,
Box 839, New York City.

AMERICAN SOCIETY OF CIVIL ENGINEERS,
127 East 23d st., New York,
May 24, 1883.

THE NATIONAL EXPOSITION OF RAILWAY APPLIANCES.

The formal opening of the Exposition took place on the evening of Thursday, May 24. At shortly after 8 o'clock Mr. Aaron French, Vice-President of the Exposition Commissioners, and during the evening master of ceremonies, introduced Prof. Swing, of Chicago, who prayed. Mayor Harrison then made a short welcoming address substantially as follows: He spoke of what the railroads had done for civilization, for this country, and especially for Chicago. They were often regarded as dangerous corporations because they might become monopolies, but Chicago had no such fears, for the railroads would always find the interest of the people their best interest. In looking back over these years what a change was visible. The first railroad, a few miles long, of wood, ran along the Tyne from Newcastle to the collieries, and was pulled by a horse, and this was probably the original bob-tail horse car. What a contrast between the old wooden tramway and the railroad of to-day! He remembered the first railroad in this country propelled by steam. When George Stephenson promised the people of England to give them a railroad which would travel at the rate of 12 miles an hour he was laughed at and frowned upon. He gave them one which traveled at the rate of 35 miles an hour. America at once determined to compete with the world, and in 1830, a year after Stephenson's success, Peter Cooper, the great and good man who has just been laid to rest, gave America its first locomotive engine. That man lived to see 117,000 miles of railways in the United States—enough to gird the earth over five times. The mayor then gave the following railway statistics: In the world there were 265,000 miles of railway. The capital invested in railways in the United States amounted to $3,195,438,154; the funded debt was $2,890,479 364; other debts, $212,766,267; total capital, $6,314, 699,787. Cost of building the roads, $5,500,996,931. The gross earnings last year were $725,325,119; the operating expenses were $449,565,071, and the net earnings $276,654,159. There were 11,000 miles of road built last year. He then continued with a reference to the first old railroad in Kentucky which he remembered. This road ran from Frankfort to Lexington in a curvilinear roadbed. Now the road-beds were straight. The mayor then closed with the statement that Illinois to-day has more miles of railroad than any State in the Union, and Chicago, the great city of the Northwest, cordially welcomed the railroad men with their inventions within her doors.

ADDRESS BY VICE PRESIDENT FRENCH.

Mr. Aaron French, Vice-President of the Expo-

sition Commissioners, then read the following address:

Owing to the absence of our President and First Vice-President it has fallen to my lot to gratefully acknowledge the hearty welcome of his Honor the Mayor and citizens of Chicago extended to the commissioners, exhibitors and visitors to this Exposition of Railway Appliances. Most of us are visitors to Chicago, but none of us are strangers to its cordiality or its enterprise.

Whether it is in extending courtesies to an honored guest, or in encouraging a charitable or business enterprise, Chicago has always been both hearty and honest, and no man, or body of men, can be brought in contact with the pulsations of its business life or its social heart without feeling gratefully encouraged.

Nor is this occasion marred by the slightest feeling of jealousy.

We, from other cities of considerable size, of immense business interests, of pride and great ambition, are not at all sorry to acknowledge that, as the operative department of railroads, Chicago is, and for a long time at least will and must be, the great center of this country. There are in this city and in its immediate suburbs more general officers controlling and operating more miles of railroad than any city in the Union.

We, therefore, one and all, commissioners, exhibitors and guests, assembled to inaugurate this great new enterprise, acknowledge the welcome we have received with one universal sentiment of gratitude and good will, with a common purpose that this shall be a success, and that good may come to this great city and all the interests here represented.

It is unnecessary for me to enter into any details as to how this Exposition should be conducted.

I would, however, offer a few suggestions to exhibitors. The first object of congregating here this vast area of railway appliances is, that those in charge of different departments of railroads may become acquainted with the improved appliances in their own and co-ordinate departments which have been developed just beyond the horizon of their labors, and of which they are more or less ignorant, on account of their devotion to their own individual sphere of work.

The superintendent of motive power of a considerable railroad property in the West, weighed down with the details and responsibilities of his own work, may not be supposed to know what lines of improvements in boilers, fire-boxes and cab equipments, and attachments in valve gears have been followed with greater or less success in the Eastern States.

So the master mechanic or the master car-builder of New England, similarly confined by daily duties, may not be supposed to know what lines of improvements have been followed with greater or less success in the construction of spark-arresters to prevent many serious fires, or in that economy and durability of construction of tracks, cars and locomotives which will permit of the longest hauls at the smallest expense.

These men are coming here, and, unless you presume upon their knowledge, you will be able to give them more information here in a month than they could otherwise acquire in a year.

A second object of importance is that the inventors, manufacturers and supply agents, being together here for a month, may consult with each other as to the best methods of promoting common progress in these arts, and of overcoming the great obstacles which now exist in making improvements, and of devising more speedy methods for the adoption of meritorious inventions in railway appliances.

A third object to which I desire to call your attention is to the education of the public in the mechanical mysteries of a railroad.

No other art, avocation, or department of the world's work, in all its history, has made such strides in its own development as has been made in the arts which comprise the science of railroading during the 50 years of its infancy. My prophecy has a foundation of certainty when I say that when, in remote ages, the happenings of to-day shall have the same relation of time to the people of that day that we now hold to the years of the artistic and philosophical splendor of Greece and Rome, that then the pæans for the past will sing prominently of the days of railroads, and will name the days in which we now live.

But the granger is still abroad in the land, and our court of last resort has said his bill has a foundation of law. We cannot afford to halt an instant in our progress, and for two reasons we must educate the people in the mysteries to which I have referred. First, that they may be more charitable to the difficulties of operating larger enterprises; and second, that they may bring to the front fresh blood, brains and enterprise.

The fatalities of our war have been many. Weariness and overwork have deprived us of many leaders, and we must recruit. Drilling always precedes fighting, and one of the important objects is to make this place for the next month a great drilling school. One special caution which I would give to our exhibitors who, though young in years, have reached manhood in these matters, is that they shall not assume that those who visit you to learn of your work know everything you did prior to your last departure of six or twelve months ago.

I will venture the statement that nine out of ten of the intelligent men and boys who ride every day on our trains, if asked to point out the pumps, pipes or reservoir of a power brake, they might point you to the hose between the cars, which looked so funny to them that they had to ask what it was.

Let, then, our explanations to each other and to the public be constant, cordial and courteous, but full and plain, and thus attain the object for which we come together.

The purview of the remarks I have attempted to make might include some additional statements as to who we are, where we come from, and what we propose, but time does not permit.

I should, however, be remiss in my duty if I did not here pay the slight tribute which lies in my feeble words to those who conceived and brought to perfection the preparations for this occasion.

The exposition was first conceived and was for many months agitated by an energetic Chicago man, who has devoted many weeks of constant and arduous labor to its thousands of details, and to whom great credit should be given. He secured the active, earnest and constant assistance of one of Chicago's most prominent citizens, who has also given his constant and untiring attention to the interest of the exposition. To them is justly due the hearty thanks of every one now and hereafter present.

I need hardly say that I refer to Mr. E. H. Talbott, of the *Railway Age*, and Mr. J. McGregor Adams, the able president of the Adams & Westlake Manufacturing Company. They, with Mr. E. V. Cherry, of Post & Co., of Cincinnati, have with great expense of time and labor practically made all the arrangements for this, of which the commissioners, the exhibitors and the visitors are bound to make an enjoyable and a profitable assemblage.

ADDRESS BY THE HON. E. B. WASHBURNE.

The Hon. E. B. Washburne was next introduced as the orator of the evening and spoke as follows:

The National Exposition of Railway Appliances is now to be declared open in these colossal structures and in this magnificent presence. The conception of this great enterprise was less than one year ago, and it has been carried forward with an energy, a zeal and a devotion only equaled by the success attending it. The subject had only to be suggested to challenge the wildest interest in many countries and among all classes connected with railway and manufacturing interests.

The purpose of the exposition, looking to the improvement in railway appliances and the advancement in railway knowledge, coupled with its benevolent objects, must commend itself to all devotees of progress and all lovers of science and invention.

When we look around and about us and behold this marvelous and wonderful display we are lost in admiration at the strength of the human understanding and the inventive genius of man.

In the presence of all these wonderful and varied inventions, fashioned into shape by the cunning hand of the artisan, revealing novelties and improvements unknown in bygone ages and of the extent of which the wildest imagination never dreamed, we bow in admiration to the genius of the age.

Uniting intelligence to science and virtue, there seems to be no limit to the advancement of the human race.

This is not the occasion to dwell in detail on railroad statistics. But I can speak a word on railroads generally. They have changed the face not only of the civilized but the savage world. In this country mighty rivers have been spanned, forests cut through and mountains hewn down. Empires have been opened up to the advancing wave of civilization, and the desert has been made to bloom and blossom like the rose. Traversed by railroads, the older organized communities have not only received their benefits, but in almost unknown regions new Territories and States have been organized, and towns and cities have sprung up as if by magic. The Altantic coast has kissed the golden shores of the Pacific sea, and nature has everywhere been subordinated to the uses and purposes of man.

The extent of this exposition is simply bewildering. More than 1,000 firms, companies and individuals are represented in these vast inclosures, covering an area of 11 acres. We may turn and turn like the sunflower and we are confronted on all sides by every possible combination of mechanical genius as connected with railroading in all its departments, forms and ramifications, from its earliest history to the present time. In the department called the "Old Curiosity Shop" the whole history of railway appliances and railroad progress is traced and illustrated.

The people of other countries have honored this exposition by the interest they have taken in it. The gracious courtesy of the directors of the South Kensington Museum, London, in sending to the exposition what is claimed to be the first locomotive that ever turned a wheel, invented and constructed by a man whose name shall never die—George Stephenson—will be gratefully recognized by all who have the pleasure of looking at it. With what intense interest we gaze on that original locomotive—the "Rocket." It proved to be a machine which did not go up like a rocket to come down like a stick, but it went up to stay up, and to revolutionize all ideas of locomotion. Added to this is the boiler for one of the first engines ever used in this country, called the "Stourbridge Lion"—probably named from the roar the steam emitted. There is also on exhibition the first locomotive ever brought to America—to Nova Scotia—appropriately named the "America;" and we greet on the platform the engineer who has run it ever since, who nursed it in its cradle, stood by it in its meridian life and is now tenderly caring for it in its declining years. There will be found further in the "Old Curiosity Shop" many old stagers, and among them the "John Bull," the "Puffing Billy," English built, and the "Arabian," built by the Baltimore & Ohio Railroad in 1834. To show the vast strides made in constructing locomotives, from the pigmies to the giants, we are invited to look at the great monster, the largest locomotive in the world—the "Mastodon"—with the enormous weight of more than ninety tons.

And here, too, we are interested in the "Grasshopper," the first locomotive which ever ran on the Baltimore & Ohio Railroad. The name does not indicate that high rate of speed which compelled the railroads of a later day to put up that huge sign at the crossings, "Look out for the engine while the bell rings."

All Illinoisans will inspect with curiosity the first locomotive that ever ran on the pioneer railroad of this State—the Galena & Chicago Union Railroad—a name that should never have been changed. The locomotive was fired up and run out on the road October 25, 1848. Perhaps I might be pardoned in alluding for a moment to the railroads of Illinois. When I first set foot on her generous soil, in March, 1840, only a few miles of what was then called a railroad, the Northern Cross Railroad, had been built, a road which was to be extended from Meredosia, on the Illinois River, to Springfield. Eight miles of track was laid in 1838, and it was on the 8th of November, 1838, that the first locomotive was ever put in operation in the State. The road did not pay expenses. The steam power was reduced to mule power, and it was a witty saying at the time that when more speed was demanded they took off the mules and put on oxen. The road was eventually abandoned. The building of the Galena & Chicago Union was commenced March 1, 1848, and carried forward to completion in Freeport, September 1, 1853. That road, therefore, was justly entitled to be called the pioneer railroad of Illinois. I have probably ridden many times behind the locomotive here exhibited, but the first time I ever passed over that road was in the summer of 1849, in a hand car from Cottage Grove, the then terminus, to Chicago. The change in the State since that time is something unparalleled in the world's history. From five miles of track in October, 1848, Illinois has become the banner railroad State in the Union, with its 9,000 miles in operation and 2,000 more than any other State, while Chicago has become the greatest railroad center in the world, with its twenty-three great lines centering here and radiating to every part of the country. We rejoice in the presence of so many of our Canadian friends and neighbors, and we thank them for all the interest they manifest in this exposition. Canada and Illinois are allied by the early ties of a common history. For a century prior to 1763, when the sceptre of France passed to Great Britain, the flag of the Bourbons floated alike over Canada and Illinois, those vast countries which comprised that Nouvelle France, the most gorgeous jewel which ever glittered in the diadem of the French kings. All Illinoisians remember with pride and gratitude that Canada gave to our State its first lieutenant-governor, Pierre Menard, a native of Quebec, a man whose long public life was without a blemish as his private life was without a stain. His devotion to the interest of our new State, his enterprise and his intelligence, his probity of character, his liberality and his benevolence, will make the name and memory of this noble son of Canada to be revered and cherished by the people of Illinois so long as the State shall have a history. There have been expositions in many countries, and nations have vied with each other in the display of all that ingenuity and taste could suggest or wealth procure, but it is safe to say that the world has never seen a more creditable exposition than this, organized solely by private enterprise, and pushed to what we see before us by private citizens, with a degree of unselfishness and devotion rarely witnessed, and without pecuniary compensation. But they will find their reward in the gratitude of that public which will appreciate all their labors and responsibilities and all the great services they have rendered to science and to mankind. Blessed by a benign

Providence, we have a country in respect of all the elements which go to make up a grand and mighty nation that has no parallel on the face of the globe. Let the great heritage which has come down to us be cherished by every consideration which should influence a people to uphold in all their force the principles of a republican government and that public and private virtue without which no nation can live. Influenced by patriotism, guided by enlightened statesmanship, and illustrated by unsullied integrity, we will, by the blessing of God, continue to march forward in the pathway of progress to become the pride, the glory and emulation of the civilized world. But I must close, for I know with what impatience you are waiting the official announcement of the opening of an exposition which will so interest and instruct you all and which must redound to advantage of science and public good, an honor to the city of Chicago and the State of Illinois, and a benefit to our country and the world at large.

HYDRAULIC ELEVATORS AND MOTORS.*

BY B. F. JONES, KANSAS CITY.

What I have to say in relation to elevators and motors will be mostly in regard to questions that their uses necessarily bring up for settlement at the water-works office; also to show how I have been able in a measure to overcome some of the many difficulties that have presented themselves, as well as to discuss and seek information as to the best way of meeting others that still have to be dealt with. At the outset, therefore, let me state that I am not an hydraulic engineer, nor have I sufficient mechanical knowledge to undertake the discussion of the construction or relative merits of either elevators or motors. This I would respectfully suggest as a very proper and interesting topic for a paper at some future meeting by some one of the many eminent engineers of this association.

The water-works of Kansas City is comparatively young, and my experience only dates back six or seven years, or shortly after its completion. At this time it was deemed advisable on account of the probable large revenue to be derived from their use, to encourage the putting in of hydraulic elevators by low water rates. With this end in view a number of contracts were made for their supply at low, special rates for a period of years, and our minimum meter rate was charged in all other cases, regardless of the quantity of water consumed. In most instances these special rates have since been found much too low, parties paying in this way being exceedingly extravagant in the use of elevators. However, the object sought was obtained, and now they are very extensively used. In fact so much has their use increased, that the question is no longer how to encourage their more general adoption, but how to properly govern those that must be supplied. At present our works furnish power to about 15 passenger and 80 freight elevators, and the number is rapidly increasing.

Before going into details, it seems proper to give at least a brief description of our water-works, as my observations are to a great extent local.

On account of the peculiar topography of Kansas City (and I believe it has more topography to the square foot than any city in the country) two systems of water supply have been provided, the high ground being supplied by direct pumping, and a pressure of about 90 pounds maintained in the business portion, and the lower part of the city being supplied by gravity, from a reservoir at an elevation of 210 feet, thus giving the business portions of the city, on high and low ground, about the same pressure. By an arrangement of valves, a combination of these two systems is effected, so that the Holly machinery can furnish an increased fire pressure at a moment's notice, into either or both pipe systems. Thus at some points the pressure is extremely high during the progress of fires, causing difficulties that do not exist where the gravity system of works is used exclusively.

Elevators have become an established institution, and in cities of any commercial importance are regarded as a necessity, hotels, jobbing houses, factories, and office buildings being considered as far behind the times when not thus provided, as a city without a water supply or a community without a "boom." The use of elevators has made it practicable and profitable to erect buildings twice as high as were formerly thought of. Perhaps some of the most notable examples of this are in New York city, where such structures as the Mills building, the buildings of the *Tribune*, *Evening Post* and Western Union Telegraph Co., tower high above the surrounding blocks, monuments of architecture, that without this modern invention would reflect little credit upon their designers. It is now found less labor to go to the fifth, sixth or even tenth floors of these great buildings than it was to reach the second or third, before their use. In these days, merchants can shoot a ton of goods to the top of their stores in less time than it would take to get breath for the old hoist or "Yo, heave O" arrangement. Thousands of dollars are sometimes expended on a single elevator, the cars are miniature parlors, and the mechanism has perhaps advanced to nearly the perfection of the modern steam engine. If then they have become such a firmly established institution, their bearing upon the water supply of cities is a subject to be carefully considered.

As before intimated, there are many questions involved in the use of hydraulic elevators, that particularly concern towns supplied by direct pumping, and perhaps other places where the supply by gravity is somewhat limited. In a few larger cities supplied by ample reservoirs and mains, some of the difficulties suggested are not serious. Very little power is necessary to perform the actual work of lifting, with either steam or hydraulic elevators, but on account of the peculiar application of the power, and the great amount of friction to be overcome, a very considerable power has to be provided. It has been estimated, by good authorities, that not more than one-quarter of the power expended in most cases is really utilized.

With all hydraulic elevators of which I have cognizance, as much water is required to raise the empty cars as though they were loaded to maximum capacity. Still, to be available for passenger purposes elevators must have capacity of upwards of 2,500 pounds, particularly in hotels, where the cars are often arranged with separate compartments underneath for baggage. In general use it is exceptional that passenger elevators are fully loaded, on the contrary less than half a load is ordinarily carried, and for this reason it would appear that no actual benefit is derived from at least one-half of the water consumed. In this connection it has occurred to me that passenger elevators could be built at no great additional cost, with two cylinders, small and large, the two piston rods of which could be connected so as to both operate the same cable, either or both furnishing power, the smaller cylinder to be used for light loads, the larger for heavy work, and the two together for full capacity, this independent valve arrangement to be controlled by a separate cable running through the car. Whether this plan is practicable or not must be left to elevator manufacturers, but it seems to me that with the Hale-Otis elevator for instance (which is conceded to be one of the best) it could easily be accomplished. Certainly some such arrangement would effect a great saving of water, and perhaps bring water bills to a point that this class of consumers could afford to pay.

Hydraulic elevators where the water is used over and over again, by being pumped from the discharge to elevated tanks, cut little or no figure in connection with a city's water supply. When fuel, first cost, attendance of an engineer, and the poor economy of the class of pumps usually employed to perform this work are considered, the cost of operating such elevators is greatly in excess of what it would be if power were supplied direct from water mains, at any reasonable rate. The following remarks will then relate almost exclusively to that class of hydraulic elevators supplied with power directly from the water mains.

Let us now consider whether they are a desirable source of revenue, and, in this, my knowledge does not exceed my actual experience. Few elevator users appreciate the great quantity of water their elevators consume, even in Kansas City, where, on account of the high pressure carried, much smaller cylinders than ordinarily are required, it is found that passenger elevators frequently consume 500,000 to 800,000 gallons of water per month, which will make a very considerable bill, at the most liberal rates. I have, therefore, concluded that the quantity of water was so large that, unless liberal concessions were made, it would be a hardship to consumers to pay their water bills, and have therefore made a special schedule, according to quantity, for elevators and motors, these rates standing below our regular meter rates, and running to the lowest point at which we think we can afford to furnish the water. This schedule brings the rate below what we would receive for almost any other legitimate use of water; and, in view of our rapidly increasing consumption, and the probability of soon having to increase all our facilities, it is an open question whether this will continue a desirable source of revenue.

In Kansas City we have elevators of various manufacture: the Hale-Otis, Ready, Smith & Beggs, O'Keefe, Kennedy, and perhaps others, each having their peculiarities, but alike demanding large openings in the mains for supply. These large openings are objectionable features with any water-works, and especially so with direct pumping. An occurrence from this cause, about two years ago, is an experience I should not like repeated, but is one that might occur whenever the pressure in the mains is depended upon to throw fire streams. In this instance a large block of buildings occupied by jobbing houses, and having three elevators, was burned down, and the elevator connections, broken early in the fire, allowing the water to pour into the cellars in the volume of about twelve ordinary fire streams. This immense quantity of water had to be supplied from a 6-inch main, fed from only one end, which left little pressure available for fighting the fire, and as a matter of course failure to subdue the fire promptly was attributed to the water-works. We have since had up hill work to restore confidence as to our ability to throw fire streams, although we have demonstrated the fact hundreds of times since.

From this time we have been gradually cutting down on the size of openings for elevator supply but under protest of the elevator agents, who have always claimed that they should be allowed at least a 4-inch opening in the mains, until we have found that under 80 to 90 pounds pressure, two to four 1-inch taps will answer the purpose, provided the water pipes are of ample size.

The "water hammer" produced by the quick acting valves of elevators has always been objectionable, both in its effect at the pumping-house and upon water mains and connections. To obviate this, Engineer G. W. Pearson has suggested the use of very large air chambers on the elevator supply, and still smaller openings in the mains, his theory being that the air chambers would not only materially decrease the concussion or "water hammer," but that they would also act as accumulators of power (or water under pressure) to be drawn from at each trip of the elevator, and replaced when it was at rest. This plan I have never seen put to actual test, but believe it to be entirely practicable, and that we will have to ultimately adopt it.

All things considered, the plan of operating elevators from tanks in the top of buildings, supplied by a small pipe connected with the water-mains, and arranged with a float valve to keep the tank filled, I believe to be the best manner of supply, except for the great additional cost of putting up such apparatus. By this arrangement the amount of water consumed is no less; in fact it would ordinarily be more than with a direct connection with the mains, but it has the advantage of taking the water in the least objectionable manner. Still, if this mode of supply were generally enforced, the large first cost and additional expense of operating would undoubtedly deter many from using elevators.

Another evil in connection with the use of elevators, and which no doubt is common, is the habit many parties have of keeping a key or wrench to turn on and off the water at the curb. This we have sought to remedy by embracing in our plumbers' rules the following: "All elevator connection in addition to the curb stop for the use of the Water Company must be provided with another valve where the pipe first enters the building for the use of occupants of the building." Without this extra valve it was found almost impossible to keep parties from using the curb valve. In most cases the persons were perfectly responsible, and as there was no intent to defraud the Company by the act, they would claim this privilege as a precaution against the pipes bursting or freezing. This practice was very generally carried on, and was the direct cause in at least two case of very serious damage. In the instances referred to, the pipes burst between the elevator and the area wall of buildings, and the valves outside had become so worn from frequent use that they would not operate, allowing the water to literally deluge the basements before the water main could be turned off.

One of the greatest causes of waste from elevators is the wearing out of the piston packing, this being particularly troublesome in most of the Western cities, where the water supplied is to a large extent from turbid streams, carrying more or less fine sand or "grit," which cuts out the packing of the pistons very rapidly. The only practicable remedy for this is close inspection, to see that the pistons do not allow water to pass, a fact that can readily be determined from the noise made in the cylinder when the elevator is in motion going upwards.

I have reserved one of the most annoying features of elevator supply for the last, hoping to work myself into a mood to do the subject justice, but doubt if it can be done in language proper to use before this dignified body. I remember on one occasion the Mayor of our city, in discussing a job of plumbing, said that it seemed to him "that even a plumber ought to know something about plumbing." Now, it would seem that even elevator agents ought to know something about elevators, but from the following incident, which is but one of many, I am led to believe that they are not infallible, to say the least. Only a short time since one of these very reliable (?) agents reported at our office that he had just attached a new indicator to the elevator of a leading hotel. He was asked: "What does it register?" and promptly replied, "Cubic feet." In this case our inspector

* Read at Buffalo meeting of the American Water-Works Association, May 15, 1883.

had already made an examination, and had correctly reported as follows: "Hale elevator; indicator started at zero February 28; internal diameter of cylinder, 12 inches; travel of piston for complete trip, 30½ feet; indicator registers for complete trip, 4."

When it is understood that we had for a long time been assuming that elevator agents knew about all there was to know on the subject, a comparison of statements of this agent and our inspector, is somewhat startling. Now let us see what the difference amounted to: At the end of the month the indicator had registered 12,994; calling it cubic feet, this register would equal 97,195 gallons. According to our inspector, this same register would equal 578,233 gallons, or a difference of nearly half a million of gallons for a single month. Our experience with the agents in Kansas City has shown that they will, if allowed, put any kind of an indicator on the most convenient point, of any sort of an elevator, without the slightest regard as to what it was intended to indicate; then report it as registering cubic or lineal feet, whichever they find the indicator marked. On the same principle they could as well change the fulcrum of a Fairbanks scale, and then claim it weighed pounds correctly, because pounds were marked upon the bar. We have lately prepared a blank, upon which these agents are required to make a detailed report upon the completion of an elevator before the water will be turned on, which it is hoped will to some extent correct this trouble.

I have come to regard an elevator indicator with a feeling of wonder. Some years ago, when the "planchette" first came out, I remember that it acquired quite a reputation as a particularly erratic piece of mechanism, but for real mystery and *innate cussedness*, on general principles, commend me to the indicator. Why, I have known an indicator after registering a nice water bill, to deliberately and without provocation commence taking it all off again, by going backward. This crab-like manœuvre the agent readily explained by saying the "ratchet had turned over," but even he was unable to show us how to make the bills after these peculiar gyrations. I also find that it is quite a favorite amusement for indicators to stop entirely, like a balky horse, after which no amount of persuasion will bring them to a realizing sense of their duty.

Even at the best, these indicators are very apt to get out of order, necessitating greater watchfulness in supplying elevators than for any other purpose for which water is furnished.

Accidents in connection with the use of elevators are common throughout the country, and in Kansas City had, until within a short time, become of altogether too frequent occurrence. The great cause of this I believe to be due to the fact that the parties who usually operate elevators are the very ones who know least about them. The corrosion of pistons, crystallization and oxidation of cables, and many other disorders common to elevators, being matters they do not comprehend. The frequency and fatality of these accidents in Kansas City finally led the city authorities to appoint an Elevator Inspector, who is under heavy bond, and whose duty is to examine every elevator at least once a month, and to grant license to run only such as he deems in safe condition. Thus far since the establishment of this office we have had no serious accidents, which leads me to the belief that in most cases a monthly examination will discover in time the causes of many terrible casualties; also that it is not safe to operate elevators unless so inspected by some competent person.

The hatchways of elevators in large buildings are points greatly feared by firemen. They well know that when a fire once reaches this shaft, it takes but a moment for it to be carried from floor to floor, until the building is soon past saving. Although this great danger is well known, it is the exception rather than the rule to provide elevators with fire-proof hatches. A properly constructed elevator should, it seems to me, be provided with hatches, or better still, built within brick fire-proof walls, with openings to be kept closed when not in use. In this way costly buildings, valuable merchandise and many lives would be saved from fire every year.

Although considerable has been said on the subject of elevators, I am aware that the ground has not been covered, and that difficulties have been pointed out more than remedies suggested. There is much yet to be brought out by the engineers, to whom the subject more properly belongs.

In the meantime, although elevators claim many of the objectionable features in the business of water supply, most of them are not of a nature that should condemn their use; on the contrary I hope that with the joining of our experience there will be an improvement in the methods of their supply. Inasmuch as they must be furnished with water, all that can be done is to adopt such rules and fix such rates as will compensate in some degree for their objectionable qualities.

WATER MOTORS.

My remarks on this subject I trust will be more to the point, than they upon the questions already discussed. Certainly my ideas are more decided, so far at least as supplying water motors is concerned.

In many respects I believe water motors furnish as nearly perfect power as it is possible to attain. A motor, for instance, properly connected and supplied by the even pressure from a reservoir is probably the most reliable and steady power known, not excepting the most improved and costly steam engines. The convenience and little attendance necessary in operating make them especially desirable for many purposes. Where only small power is required, or even where considerable power for only occasional use is desired, they are particularly well adapted, and can be driven at small expense. Even for greater power they possess advantages over steam engines which, to a considerable extent, compensate for the large water rates that ought to be paid for their supply. These advantages are, in the first cost of a motor, as compared with a steam engine, the saving in attendance and fuel, the convenience and cleanliness, and in some cases a saving in insurance by reason of their being no fire risks attendant upon its use. At just what point steam becomes preferable, however, is a question depending considerably upon water rates, but to some extent on other circumstances, leaving it largely a question of judgment. As with elevators, there are difficulties involved in their supply that unless carefully guarded make water motors anything but a desirable source of revenue. How often is the argument advanced: "Why, I only use water for a quarter of an inch jet." Showing how little people who use motors or elevators or fountains realize the quantity of water they consume. This class of consumers may be placed on one footing—to wit, a class who, in spite of the fact that they are supplied with water for much less than any other, feel that they are imposed upon, and cannot be made to think otherwise.

Though not as large as for elevator supply, water motors require liberal openings in the mains, and frequently the fault of having too small supply pipes is sought to be remedied by openings in the water mains much larger than needful. A table prepared by an engineer who had given the matter study, or by some motor manufacturer, showing the size of taps, or openings, for the proper supply of motors, with the various jets, under different pressures, would be of general use to water-works people. In order to use water to the best advantage, the full pressure in the main, so far as practicable, should be had at the jet, but in order to accomplish this it is not necessary to use as large taps as are ordinarily demanded, but to provide supply pipes of sufficient capacity to deliver the water to the point of discharge with the least possible friction. Lately this theory has been put in practice to some extent by us, and the result has shown that in this manner we are able to supply motors through smaller taps than before, and with as satisfactory results.

It is a general practice throughout the country to make annual or monthly rates for water motors, and from my observation I believe I can safely venture the assertion that in three-quarters of the cases the rates charged will not equal 50 per cent. of the lowest meter rates in force in these places. Although the Kansas City Water-Works has not perhaps been generally accorded the reputation of being the most liberal "monopoly" in the country, still I have had occasion at times to make some such claims as an inducement to its generous support. But with all its liberality, I am free to say that we cannot begin to meet the rates for motors that parties claim to have paid almost everywhere else.

The St. Louis Water-Works, where the rates are substantially the same as in Kansas City, have been quoted as having the following motor rates, but whether correct or not my inquiries have failed to determine:

"On the supposition that motors are to be used ten hours per day for 300 days per year, motors are assessed for

¼ inch jets	$120 per annum
⅜ " "	198 " "
½ " "	300 " "

These rates based upon a charge of 20 cents per 1,000 gallons."

From Col. Flad's Report as Engineer of Public Works, May 1 1876, page 70, it is found that with 42 pounds pressure a ½ inch orifice will discharge 2,160 gallons per hour, 21,600 gallons in 10 hours, or 6,480,000 gallons in 300 days, which at 20 cents per 1,000 gallons would amount to $1,296. for which they assess the rate $300. From all of which I would conclude that there must be a lack of harmony somewhere between the engineering and office departments.

I have made some estimates myself for water motors, basing rates upon the number of hours it was claimed the motors would be in use, and afterward supplied the same motors by meter measurement, in every case found that at least twice as much water was used as has been estimated. Although estimates were carefully made upon what was believed to be a reliable basis, these repeated similar results have led me to the conclusion that the only way to supply motors is to make it an object to the users of them to be economical. In other words, I believe the way to supply water motors is upon an estimate that they will run 24 hours per day and 365 days per year, or, more properly still, supply them only by meter measurement. At all events this is henceforth my policy; or, in other words, "on this rock I stand," believing it the only equitable way out of this difficulty.

That class of motors or water engines, operated by water pressure in close cylinders upon pistons as with steam in a steam engine, I believe could be easily supplied by measurement of water without a meter. This could be accomplished by the use of "revolution counters" or indicators, as the amount of water required per revolution could be readily determined, and when once computed the cylinders would measure out the water as accurately as a meter. The only objection to this plan is the expense of counters, which is considerable; and as to indicators, it may have been observed that I have little faith in their reliability. With cheap revolution this class of motors would be free from many of the objections raised in regard to motors generally.

The practical conclusion that I would draw from a consideration of this subject is that the question of whether the supply of hydraulic elevators and motors is desirable in its effects upon the water supply is one that hinges so delicately upon their being carefully governed, connected and restricted, that while on the one hand they may be made the source of large profit, and at the same time a public benefit, on the other hand, unless all the details of their supply be carefully guarded by the wisest rules and greatest watchfulness, their capacities for waste are so great and the rates charged necessarily so low, that they may become the greatest source of loss with which we have to contend. I therefore trust that this discussion will be continued until an interest is felt that will result in our all receiving much useful information upon two most important factors of our business.

As this paper has been long for the information contained, I will close with the earnest wish that it may at least be of service in bringing these important but often neglected subjects to the attention of the thinking and intelligent body of men, of whom many have had much longer and more general experience in relation to these matters, and whose views when expressed will consequently be of more interest and have greater weight. Thus as a result may we all derive the benefit of whatever useful information there is to be gained by this annual interchange of experiences in the all-important business of public water supply.

THE STORM KING BRIDGE.

The projectors of the above bridge claim a right to build despite the non-approval of the governor. A law passed in 1880 empowers the construction of bridges for railroad purposes. Mr. Chas. Swan, the general manager of the company thus expressed himself: "The bill that we introduced last winter, and which the governor refused to sign, merely made the law more clear, and restricted the length of spans to 700 feet. And under the law our company can make its spans less than seven hundred feet. It is idle to say that spans of 700 feet would obstruct commerce, and with a height of 150 feet through which vessels could pass. As it is, the spans may be made any length. Now we have a law to bridge the Hudson, and we propose to use it.

"The proposed bridge would give to the New York & New England Railroad, with the Erie, the New York, Lake Ontario & Western, the Pennsylvania, Slatington & New England, the Lehigh Valley, the Delaware, Lackawanna & Western, the Pennsylvania Central, the Philadelphia & Reading and the Baltimore & Ohio an all-rail route to Boston and the Far East. This bridge will be the means of making an all-rail route from the coal fields to New England, and also to this city, and coal can be landed in the heart of the city without break of bulk. It will do more. It will permit the West Shore Railroad passenger trains to pass over the bridge and into New York City via the New York City & Northern Railroad and over the elevated railway system."

RED BANK (N. J.) WATER SUPPLY.—The authorities of this town, which has suffered so much from incendiary fires, have now agreed to contract for a water supply at $3,000 per annum. The law gives the authorities permission to expend annually a sum of money equivalent to $1 for every inhabitant of the incorporated district. The census of 1880 showed that only 2,500 people lived in the borough, and many persons are questioning whether the Town Commissioners, in agreeing to pay $3,000 for a water supply, have not exceeded their authority.

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LOOKING for capital is a not uncommon experience, not only with those who have none, but with those who have. Looking for "a capital" is, however, something that is just now peculiar to far Western territories. Dakota has just elected Bismarck, and there would seem to be anything but unanimity of sentiment about the choice. Bismarck—the city of—bid $100,000 cash, 320 acres of ground (and a guarantee that 180 acres of this would sell for $300,000). No sooner were matters "consummated" than the Superintendent of the Milwaukee & St. Paul purchased 120 acres for $20,000. It is surmised that the company will extend its line to Bismarck, a distance of 100 miles. Real estate has advanced, and the new Capitol and other public buildings will attract the attention of contractors that are not too far away.

THAT was a very curious accident that occurred to the north reservoir of the new Knoxville (Tenn. water-works last week, when the "bottom dropped out" and all the water suddenly disappeared. But to the native Kentuckian or Tennesseean there is nothing rare or startling about it. He was brought up with the idea that the world beneath him was "hollow! hollow! hollow!" and that the Mammoth and Luray caves were repeated or possibly extended beneath the two States, if they could only be traced. Ponds are formed in these States by carting in clay to fill up the sink hole, pouring in water and turning the cattle in to "puddle" it. The sink holes are met with everywhere in Kentucky, and hence it is not so very surprising that one was developed at Knoxville. We may, however, express some little surprise that thorough investigation did not reveal this particular leak. Probably it is explainable by the engineer.

THE SCHOOL OF MINES QUARTERLY.—The June number of the *School of Mines Quarterly* contains several most useful and interesting papers. The first, on "Stone Cutting," is by Prof. W. P. Trowbridge; it is very fully illustrated, and the description of the method of working, is by a practical and intelligent stone-cutter, wisely called to the assistance of the author of the article. The paper on "Signal Tripods" for Trigonometrical stations of the New York State Survey describes fully the manner of establishing these signals, both on the State work and on the somewhat less important survey made by the Summer class in Geodesy of 1883, at Otsego Lake. Prof. R. D. Irving of the University of Wisconsin sketches the progress of the United States Geological Survey, from its inception about 1824 in North Carolina to the elaborate work of Hayden and Clarence King. Not the least in interest in the contents of this number is the address of F. Aug. Schermerhorn, President of the Graduate Department of the Columbia College School of Mines. He gives in a concise form the origin, rise and present condition of the college, its revenues and its expenditures. His address contains a fund of interesting college statistics.

A THREE HUNDRED AND THIRTY-THIRD BIRTHDAY.

For so ancient a burg, Santa Fe is making exceedingly active preparations for a fitting celebration of the 333d anniversary of its birth; the "Centennial" of our common country pales, in time at least, before this "Tertio-Millennial" of the oldest European settlement within our borders.

The Exposition commences July 2 and closes August 3. In the extent and variety of its vast mineral resources and native products of all kinds, in its delegations, with war dances by the Apaches and Navajos, and the peculiar religious ceremonials of the Zunis, with its Mexican games and tournaments; the celebration promises to be both interesting and unique in the nature of its exhibits.

Special rates are arranged for upon all roads west of Kansas City, and many excursions are being organized; W. W. Griffin is the President of the Association.

THE ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

The Convention to be held at St. Paul and Minneapolis on June 19 will be the fifteenth annual convention of the Amer. Soc. C. E., and believing that the subject will be one of general interest to engineers at this time, we have gathered together, as well as the meager data at hand would permit, the statistics of the previous conventions, giving dates, place of meeting, objects of interest visited, and the attendance at each, as near as we can.

Convention No. 1 was held in New York City, commencing June 16, 1869; the attendance and programme is not on record.

Convention No. 2 was likewise held in New York, and was called for June 15, 1870, forty-six members were present, and the chief point of interest visited was the submarine excavations then going on at Hell Gate, in the East River.

Convention No. 3 was held in New York on June 21, 1871; no record of members or visits.

Convention No. 4 was the first one convened outside New York City; Chicago was the place fixed for the meeting, June 5, 1872, the date: 72 members attended: and the first lake tunnel and other points of interest about the city were visited.

Convention No. 5 was held in Louisville, Ky., on May 21, 1873. Seventy-nine members were present; the Mammoth Cave was one of the chief attractions.

Convention No. 6 met in New York City on June 10, 1874; 179 members attended, and the points visited by the society were the Hell Gate excavations, the East River Bridge, then in progress of construction, the Stevens' Institute of Technology, the Stevens Battery, the Harlem Bridge and the new docks at the Battery. The convention closed by excursions to the Wyoming coal-fields and the switchback at Mauch Chunk.

Convention No. 7 was called at Pittsburg, Pa., on June 8, 1875; 85 members answered roll-call, but no record of their movements is to be found.

Convention No. 8 assembled in the Judges' Pavilion, in the grounds of the Centennial Exposition, in Philadelphia, Pa., on June 13, 1876. The attendance was large, and much time was spent in examining the many engineering attractions of the Exposition. Outside of this, visits were made to the Dry Docks of the Messrs. Cramp, the Shaw Gunpowder Pile Driver and the American Dredging Co.'s works. There was an excursion over the "Bound Brook" Railroad to New York, only opened a month before, and a most enjoyable trip to the Schuylkill and Lebanon valleys, with their mines and iron works. These last excursions were at the invitation of the Philadelphia & Reading Railroad Co., and were made in the company of the American Society of Mining Engineers and the foreign engineers attending the Centennial.

Convention No. 9 took place at New Orleans, La., April 24, 1877, and was notable as being the first one at which the wives and lady friends of members were invited to be present. The trip to New Orleans was made by rail, via Louisville, Nashville, Montgomery, Ala., and Mobile; 132 members and guests attended. The cotton-presses, ice manufactory, fireless locomotives, levees, and water supply were the attractive points within the city limits; excursions were made to the late crevasse at Bonnet Carre, to Lake Ponchartrain, to the jetty works at the mouth of the Mississippi, visiting the famous "Magnolia Plantation" on the trip, and to Galveston Harbor.

Convention No. 10 met at Boston, Mass., on June 18, 1878; the number of members and guests present was 164. This was a most successfully managed convention, thanks to the local members and the Boston Society of Engineers. Trips were made to the Sudbury and Cochituate water supply, about Boston Harbor, including the forts, the Deer Island institutions, and Minot's Ledge light, to Lowell and Lawrence, where the print mills and pumping engines were examined, and the method of measuring out water to the different manufactories for motive power, was practically explained by J. B. Francis, the Chief Engineer locks and canals on the Merrimack River. The Convention closed with an excursion to Mt. Washington and points of interest in the White Mountains.

Convention No. 11 was held at Cleveland, Ohio, on June 17, 1879; 152 members and guests attended. The Davis Island Movable dam, and the Edgar Thomson Steel Works were visited by the Eastern members on their way to the Convention. In Cleveland the viaduct, water-works, and many manufactories, etc., were examined, including the works of the Standard Oil Co., the Union Steel Screw Co., the Otis Iron & Steel Co., the King and the Cleveland Bridge Cos. and Cleveland Rolling Mill. Members were invited to excursions on Lake Erie, to the Berea and Amherst stone quarries, to the Mahoning Valley coal fields and the Bradford oil district. Eastern members returned home via Niagara Falls.

Convention No. 12 took place at St. Louis, Mo., on May 25, 1880; 161 members and guests are on record. The St. Louis bridge and the St. Charles bridge were visited, together with the water-works, the Vulcan Steel Works, the Missouri Zinc Works, St. Louis Smelting Works, La Clede Fire Brick Co. and the Meier Iron Works. Trips were made to Pilot Knob, to the Iron Mountain and to Crystal City, and also to the new bridge at Plattsmouth, near Council Bluffs.

Convention No. 13, the first held outside of the borders of the United States, was called in Montreal, Canada, June 15, 1881. The majority of the American members attending met at Niagara Falls, and, after seeing all the attractions of that place and examining the lately-strengthened railroad suspension bridge, etc., went by rail to Toronto, where they were for a short time the guests of Colonel Gzowski, Mem. Am. Soc. C. E., thence by steamer down Lake Ontario and the St. Lawrence, through the Thousand Isles and all their beauties, to Montreal. One hundred and thirty members and invited guests assembled in the hall of the McGill University. Too much praise cannot be measured out to the local members of the Society and the Canadian citizens and railway authorities, who did so much to make this meeting the most novel and generally interesting convention held to date. Private entertainments, drives about the city and to Mt. Royal Park, an excursion about Montreal Harbor, including a visit to the Lachine Canal and Victoria Bridge were among the enjoyable features of this convention. A trip was made by rail to Ottawa, where the Parliament buildings, so beautiful in both design and location, were examined; an exciting bit of a ride taken through the "timber chutes," at the Chaudiere Falls, and a dinner enjoyed, which was given to the Americans by the city authorities of Ottawa. Quaint Quebec, with its gates and walls and French-speaking inhabitants, the Plains of Abraham and the Falls of Mont-

MAP SHOWING LOCALITIES OF ANNUAL CONVENTIONS OF AMERICAN SOCIETY OF CIVIL ENGINEERS.

morenci, made a fitting ending to this thirteenth Convention.

Convention No. 14 opened at Washington, D. C., May 16, 1882; 105 members and their guests attended. Visits were made to the Capitol, the different public buildings, to the Washington Monument, the Navy Yard, the Washington Aqueduct and famous Cabin John arched bridge, and to Mount Vernon.

In connection with the above statistics of the several conventions, we publish a map of the country covered by the annual trips, supposing for this case that all routes radiate from the headquarters of the Society in New York City. The map shows that the Society has at some time since these annual conventions were inaugurated, visited nearly all of the principal cities of the Eastern, Middle and Western States. New Orleans is the only Southern town so far selected as a place of meeting; and St. Paul, the site of the coming Convention, the first city of the Great Northwest chosen.

The number of members and guests attending each Convention shows an increasing interest in the purpose of these annual meetings, but also proves that the place selected has considerable influence on the attendance. New York, as the metropolis of the country, a point of common interest, and the headquarters of the Society, with a heavy local membership, always attracts the largest number of members. But the annual shifting of place of meeting from one city to another has advantages aside from the mere numbers that may be gathered together; engineers meet who never met before, who perhaps, but for this opportunity, would never meet; lasting friendships are made and valuable business relations brought about; the engineering methods of different sections, construction demanded by differing local conditions, can be examined and compared. It is a school for engineers, and valuable in direct proportion to the number and standing of the members of the profession who take part in it; it is the personal contact with men of like pursuits, and of varying degrees of knowledge and experience in that pursuit that is productive of most good; old and petted theories may be exploded by those who have studied the subject more deeply, but birth may also be given to new ideas more practical and valuable.

The advisability or non-advisability of reading "Papers" at the annual Conventions has been a bone of contention among members for years past; some claim that this is the chief end of such meetings; that a "Paper" should be read in all its length, no matter how ponderous, or how it bristles with mathematical formulæ; that it should be there discussed "if it took all summer;" that the social element should be frowned down, and, above all, that the "fair sex" should be forbidden to waste the valuable time of so learned a gathering, that they should be excluded, in fact, altogether.

We differ radically from the above malcontents; a "Paper" can be studied with more profit in the quiet and privacy of one's own office; the discussion of the paper will be more profitable to others when the facts are first carefully weighed and compared with other data in our home library; such professional debate from its very practical form demands leisure, and cannot be successfully carried out in the midst of the detracting influence of a visit to a new locality, and surrounded by new faces and novel conditions. There is certain formal business that must be transacted at these annual Conventions; let that be got through with as speedily and orderly as possible; read by "title," if you will, the papers of the year, but publish and discuss them in the "Transactions" of the Society, or at meetings at home devoted to this purpose solely.

The annual Convention is the annual "summer jaunt" of the majority of the members present; it is probably the only one their duties will allow them. They come for pleasure as well as profit, but the profit they would derive from sitting in a crowded room, having a paper read at them that but few can hear, and fewer still digest, in that shape, is questionable. The real profit, as we regard it, is to be gained from the "solid chunks of wisdom" that may be picked up in a social chat with men whose lips would in many cases remain sealed during a public debate, who in truth *can* talk, but are not aware of the fact; the members who *would* talk on such occasions can, and nearly always do, write; so we lose nothing on that score.

CONVENTION NOTES.

The following members have to May 29 signified their intention of being present at the 15th Annual Convention of the Am. Soc. C. E., to be held at St. Paul, commencing June 19.

E. R. Andrews, J. B. Atkinson, J. Archbald, T. Appleton, W. H. Burr, C. Blackwell, A. Beardsley, E. S. Bowers, W. R. Belknap, J. D. Burr, H. R. Bradbury, W. L. Baker, C. P. E. Burgwyn, D. Bontecou, W. H. Bradley, E. C. Burns, C. L. Burdette, C. L. Crandall, W. B. Cogswell, M. Coryell, D. W. Cunningham, J. J. R. Croes, R. Cartwright, A. P. Clarke, E. A. Doane, M. M. Defrees, P. P. Dickinson, C. E. Emery, T. Egleston, M. T. Endicott, N. M. Edwards, F. N. Finney, F. U. Farquhar, R. Fletcher, J. P. Frizell, J. R. Freeman, C. G. Force, Clark Fisher C. E. Goad, F. Graff, J. M. Goodwin, D. M. Greene, C. E. Greene, Geo. S. Greene, Jr., T. L. Gillespie, C. L. Gates, J. P. Gould, E. L. B. Gardiner, W. A. Haven, W. P. Harris, F. B. Howard, J. H. Hanlon, W. M. Hughes, B. M. Harrod, C. Hermany, S. A. Harrison, W. S. Huntington, H. Harding, M. G. Howe, H. E. Horton, R. Hunt, L. M. Johnston, L. H. Knapp, John Kennedy, W. B. Knight, G. Lindenthal, D. J. Lucas, C. F. Loweth, John Lawler, D. E. McComb, R. E. McMath, Wm. Metcalf, C. E. Moore, H. G. Morris, T. H. McKenzie, G. W. McNulty, R. C. Morris, O. E. Michaelis, F. O. Norton, S. B. Opdyke, J. A. Ockerson, T. W. Putnam, A. B. Paine, F. C. Prindle, W. A. Pratt. E. Prince, G. H. Pegram, P. Roberts, Jr., T. R. Richards, R. L. Read, T. L. Randolph, H. B. Richardson, B. Rhodes, G. M. Rusling, C. Shaler Smith, W. H. Searles, R. Surtees, W. P. Shinn, D. McN. Stauffer, Wm. Sooy Smith, F. Slataper, R. A. Sharter, F. P. Stearns, H. E. Stevens, T. G. Sanderson, E. N. R. Talcott, E. Thatcher, A. L. Tulloch, W. H. Wiley, Jos. Wood, D. W. Wellman, G. Y. Wisner, H. R. Weeks, S. Whinery, J. W. Weston, Dr. F. M. Wolff, B. F. Morse, C. D. Ward, Jno. Bogart. About 65 ladies thus far are registered for attendance.

The following additional names have been received to June 6: A. Bonzano, J. F. Barnard, G. H. Beuzenberg, W. H. Bixby, M. J. Becker, D. P. Bruner, F. Collingwood, C. B. Davis, G. D. Emerson, A. J. Frith, James B. Francis, A. Fteley, S. M. Gray, Rudolph Hering, G. P. Low, W. H. Lotz, Geo. H. Frost, B. F. Morse, Niles Meriwether, T. C. McCollom, James MacNaughton, Robert Moore, P. H. Philbrick, C. C. Smith, Arthur H. Scott, W. J. Taylor, George H. White, W. W. Walker, C. J. Poetsch, Benjamin Reece, D. J. Whittemore, C. E., L. B. Davis and Onward Bates.

Mr. THOS. B. LEE, Chief Clerk of the American Society of Civil Engineers, will arrive in Chicago June 11, to establish an office for the reception of members, etc., at the Leland Hotel.

At the meeting of the Society on Wednesday evening Secretary Bogart said that there was nothing new to announce. The arrangements for transportation of Western and Southern members had been completed, and the indications were that the convention would be a very largely attended one, and that it would be a notable one on account of the special efforts being made to entertain the visitors by the Western committees. The list of names thus far received does not fully represent the delegates from the East. Every engineer *wants* to go, and as the time for final decision draws near, there is no doubt that many of the wavering ones will "fix up" their business engagements and take the vacation.

Secretary Bogart and the majority of visiting members from the East will leave New York on Wednesday evening by the Pennsylvania Central Railroad. This should be the favorite route with engineers, as the Pennsylvania Railroad Company has been exceedingly liberal above all other of the trunk lines in their courtesies to the American Society of Civil Engineers. It is a good thing also that it is the most comfortable of all the routes to travel over.

THE IMPROVEMENT OF GREEN'S POND AT LONG BRANCH, N. J.

BY GEORGE HILL, RESIDENT ENGINEER.

This improvement, the contract for the grading of which has just been completed, consists in controlling the height of the water in the pond and its outlet into the ocean, so as to keep it open at all stages of the tide, and running in nearly a constant direction, thereby preventing the destruction of adjacent property and removing the mud, consisting of sand and decaying vegetable matter, from the bottom, so as to make it firm and level, and destroy any malarial influences which may exist.

From the material thus obtained a roadway is to be built and covered with the gravel which soundings show underlies the greater part of the pond.

The place has long been an eyesore and source of apprehension to property holders in the vicinity, and two years ago steps were taken by the forming of an association of the cottagers with an executive committee of three, composed of Messrs. J. V. Brokaw and J. W. Curtis, of New York City, and G. W. Childs, of Philadelphia. Mr. Frank H. Earle, C. E., of Jersey City, N. J., was appointed engineer for the committee, and acting on his plans, a title was acquired to the pond property by purchase and otherwise.

On April 12th, 1882, ground was broken in the first part of the undertaking, namely, building the road from Ocean avenue eastward to the dam and building the dam.

The road was built of material taken from the pond and was completed on May 1st. The dam, begun at the same time with the road, was not completed until the end of August, owing to trouble with men and bad weather. It was constructed throughout of yellow pine timbers, and sheet piling and white oak piles on the plans shown in the sketch. The space between the parallel rows of sheet piles was filled with a puddle of equal parts of clay, gravel and loam. This was found to be excellent except in the sluiceway where, owing to the bad nature of the ground it was found impossible to drive the sheet piles water-tight, and the water, washing around in small streams, carried away considerable of the puddle, so that it was necessary to sheath the slime with 1¼-in. yellow pine tongued and grooved boards and fill in behind them with concrete mixed in the proportion of one of Rosendale cement and one of sand, thus making it perfectly watertight.

The piles were 24 and 16 feet long, and were driven without difficulty with an 1800 pounds hammer 30 feet fall, an average of 70 blows sending them to a grade. The sheet piles on the dam were driven with a jet of water passing from a Worthington pump, through a 2-in hose with 1¼ in. gas pipe 12 ft. long for a nozzle.

This worked very efficiently in sand, but when the piles met the tough black and yellow clay, through which the last five feet were driven, it was necessary to use a heavy tap as well.

In building the stairway so much sand was washed away that the piledriver was mounted on the caps and drove the sheet piles with the hammer alone, but with a fall not exceeding five feet, and in this way 100 sheet piles were driven in one day of 10 hours.

The grading of the pond was begun on Oct. 16, 1882 (before the sluice was built), and proved a job of greater magnitude than was anticipated. In order to understand the difficulties overcome, I would state that the proposed grade of the pond had an elevation of 7 (on an average), ordinary

high water in the ocean 8.5, minimum high water 5.5, and storm tides 12. The pond is fed by a stream large enough to raise it 2 in. an hour before it was cleared, and by springs that now raise it ⅜ in. per hour, and as the sluice way was not built when the work was opened, it was necessary to dig out the beach nearly every tide the first two months in order to take the water through, and then the minimum elevation obtained was 8.

The course of the brook and the nature of the bottom are indicated in the accompanying sketch.

We first dug a trench 20 ft. wide and 1 ft. below grade from the culvert under the railroad track to within 100 ft. of the Ocean avenue bridge and then started on the lowest points of the bottom, throwing up a mud dam around a space about 100 ft. square and putting in a gang of 50 men wheeling and shoveling. One pump was used, and in some cases two, continuously to keep it dry, and even then the mud was in a semi-liquid state.

The mud covering the bottom of the pond, as before stated, is composed of sand and decaying vegetable matter, and this on exposure was cleansed by rain and frost to such an extent as to leave the sand almost pure. It was used to form the bulk of the roadway around the pond, and was covered by gravel and clay taken from the bottom under it to a depth varying from 6 in. to 2 ft., the last 6 in. being carefully selected and thoroughly rolled, so as to obtain the best possible wearing surface for the road.

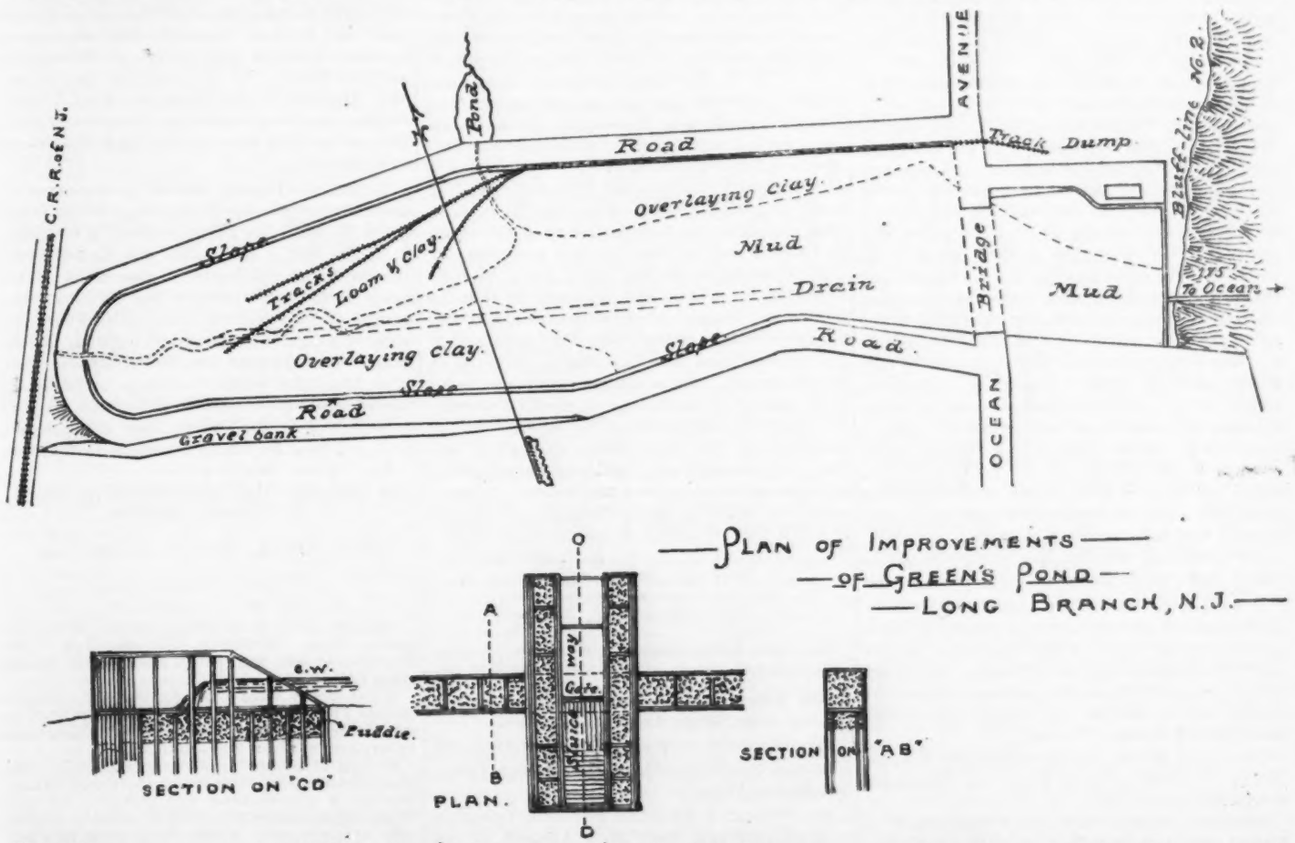
The bottom, from being miry and in places dangerous, has become now, by the action of the springs and superincumbent water, firm and clean in almost every case, and it is safe to predict that now the accumulation of vegetable matter has been stopped, and what was in there removed; the bottom will, within two years' time, be uniformly hard. Even now the improvement is so great that wagons were driven directly into the pond and to 40 teams, but there was considerable broken time owing to the extremely severe weather.

The brook at the end of the pond is crossed by a temporary wooden box 9 ft. square, made of 8 in. by 8 in. Y. P. timbers and 3 in. by 12 in. Y. P. planks. This is put in pending the action of the N. Y. & L. B. R. R. in regard to a bridge, and on its completion on April 12 the pond was practically completed, although it was not officially inspected by Mr. Earle and the committee until May 18.

The improvement contemplates the building of boat-houses, building a fence around the pond, sodding banks and slopes and graveling with Shark River gravel, but this work is reserved for a future season.

The pond is 2,100 ft. long, 430 ft. wide at widest point, and can be filled with either salt or fresh water.

Ocean avenue crosses near the east end on a very pretty 8-span deck bridge, built on screw piles by the Cleveland Bridge & Iron Co. last season. In a



Three of these gangs were put at different places around the pond, each gang finishing entirely every place opened up in a day. When this was not done it was necessary to pump out the entire place next morning, since it was found impossible to maintain the dams during the night.

At the same time that the wheeling was going on, a track of 30 in. gauge was laid on the north side from Ocean avenue down for 800 ft., and then with three switches into the pond and 20 dump cars, holding 2½ cubic yards, were used on this track with a gang of 50 men loading and four teams of horses drawing them out of the pit. This track was necessary, since the bulk of the excavation was at the west end of the pond and the heavy fills and waste grounds at the east end. Toward midwinter the ice drove us away from the cars, but as we had been able to expose the flats, 6 in. of frost was formed in them, and 15 carts and teams were put on them, going out on roads on the south side, and in this manner the roadway on the south side was formed. The same general plan was pursued, however, *i. e.*, a dam was left each morning and a trench dug beside it to act as a draw and to receive the dam when no longer needed, and the bottom finished after each day's work.

loaded with ties and rails where the track was torn up in April.

The sluiceway, which was continued out to the edge of the bluff, has been found to work perfectly, keeping the outlet open and straight at all stages of the tide, when the pond water is raised to its grade of 11.5, although the sand is banked up on both sides of it for 150 ft. back from the end. The beach here has been subject to great variations in width, but now, owing to the constant outcoming of the water, it is building out.

The work throughout has been one of great difficulty, requiring great perseverance, constant care and considerable foresight, and great credit is due the contractor and his superintendent for the thoroughly satisfactory manner in which the job has been accomplished.

Men of every nationality have been employed in the work, the majority, however, being Italians. They are boarded in three large shanties faced with felt and two small ones, and obtained supplies from a store kept on the work. Besides these shanties there were three large stables, a house for the firemen and a blacksmith shop kept on the work, two blacksmiths being constantly employed in repairing cars, carts and wagons. The force ranged from 100 to 300 men and from 20 cars and 12 carts

word, an extremely bad piece of swamp land has been changed into a beautiful lake, and property that two seasons ago was inaccessible and undesirable offers now what is considered by some the finest building sites in Long Branch.

MINOR FOREIGN ENGINEERING ITEMS.

[Especially arranged from exchanges.]

The Italian government will soon have to consider a bill for building a tunnel between Italy and Sicily. Its length will be 13,546 metres; the grades will be 35 per 1,000 on the curves. The cost is estimated at 71,118,460 francs, including a section of 10 kilometres that is to connect the tunnel with the Messina station.

The engineers of the Italian government estimate have drawn up plans for improving the river Tiber. The cost is estimated at $10,000,000. The whole work has been given to the Engineer Conrad Zachokke, of Paris, in conjunction with Terrier, of Paris.

The French ministry of public works will proceed to a general survey of France in the course of the year. The cost is placed at 22,000,000 francs.

Dr. William Wallace, the Glasgow city analyst, has recounted the story of a very serious but i

structive accident, which took place near Alloa. In the construction of a railway bridge over the Forth a number of cylinders were sunk into the bed of the river. They were built of iron rings six feet in diameter and several feet high, and made a total height of 60 ft. The space round the sections was filled up from the inside by a rusting composition of iron turnings mixed with sulphur and sal ammoniac. When wetted, this mixture oxidizes, and swells up so as to fill the spaces into which it is thrust. It was applied to the joints by one man. One day last May, however, when there was a perfectly still, somewhat hazy, atmosphere and considerable heat without direct sunshine, this man was observed to become overpowered by some "mysterious influence," and a companion descended by a windlass to bring him up to the top of the cylinder. He managed to get the man into the bucket of the windlass, so as to get him hauled up into purer air; but the deliverer himself succumbed to the same influence, and falling into a pool of water at the bottom of the cylinder was unfortunately drowned. One of the contractors now descended, taking care, however, to fasten a rope to his body, and it was fortunate he did so, as he also succumbed and had to be pulled out by the rope. Dr. Wallace was called in to account for this fatal accident and traced it to the absorption of oxygen by the rusting compound, thus depriving the air in the cylinder of its sustaining power. The oxygen combined with the iron and sulphur of the mixture, and the state of the atmosphere prevented free circulation of fresh air into the cylinder. The result was that the gas breathed by the man was nitrogen, or air robbed of its oxygen. The normal proportion of that gas in the air is 20.9 or 21 per cent., and Dr. Angus Smith has shown that this proportion cannot be altered, even by one-fourth per cent. without producing appreciable effects, while a loss of one-half per cent. gives rise to serious inconvenience, and air containing only twenty per cent. of oxygen may produce grave consequences if breathed for a considerable time. When the deficiency of oxygen exceeds this to a sensible extent a candle refuses to burn, and a man exposed to it soon becomes insensible. Dr. Wallace's interesting conclusion is worthy the attention of engineers in general.

In addition to the military attachés of Germany at Paris and Washington, we are informed that a special corps of engineers was sent some months ago to the United States and France. Their duty is to report on public works, and especially on hydraulic works, bridges, etc. Their observations are published in a special organ.

The French Senate has been considering the project of a northern canal to Paris. M. Flamant is the author of the plan.

South Africa promises to be a profitable field for water-works companies. Port Elizabeth has now a water supply from the Van Staaden's River. The minimum discharge of the feeder is 350,000 gallons per diem. The pipe track is 28 miles; the diameter of the main varies from 12 to 9½ inches; the inclination of the gradients from 1 in 90.8 to 1 in 394.3. The works were carried out under seven contracts. Thirty-two per cent. of the Cleveland pipe was cracked when landed. The total of the several contracts amounted to £132,212.

A few days ago a remarkable sale was held of shares in the New River Water Co., the oldest undertaking of the kind in England. One half of a "king's share," and smaller portions of other "king's shares" were up at auction, together with twenty £100 shares of a new issue. The "king's shares" are freehold property, and are passed by deed like land. When James I. assisted the founder, Sir Hugh Middleton, with funds to complete his great undertaking, a moiety of the entire concern, divided for the purpose of this arrangement into 72 equal parts or shares, was assigned to the king, and subseqently this moiety, or 36 shares, was reassigned to the company in consideration of an annual payment of £500 forever. The present income of the shares so commuted was last year £92,000. In 20 years the dividend per share has risen from £876 to £2,541, and the company's income from £210,000 to £473,000. At the sale the property was divided into 83 lots, the "king's shares" being sold in fractions of one-hundreths, one-hundred and sixtieths, sixtieths, and one-hundred and ninety-seconds. They realized at the rate of about £91,000 for an entire share. The new issue of shares of £100 each brought £385 apiece, and the entire proceeds of the sale, which extended over 3 days, amounted to upward of £60,000.

KNOXVILLE WATER-WORKS.

KNOXVILLE, Tenn., June 2, 1883.

EDITOR ENGINEERING NEWS:

I think it might be of interest to your many patrons to know the facts relative to accident at reservoir in this place. This is a strange place, for it is a very common thing for the bottom of cisterns to fall out and the water therein to go—where no one knows, possibly for the benefit of those gone before. But to facts. There are two reservoirs, each to contain about 2,000,000 gallons, one to be used as a settling and the other as a distributing reservoir. Water is pumped therein by two of M. T. Davidson's compound condensing engines, 2,000,000 gals. each capacity in 24 hours. Everything had been thoroughly tested, the engines worked most beautifully and quietly; all the mains had been filled and about 500,000 gallons in each reservoir. Engines had been stopped and all made snug for the night, when Mr. F. M. Loweree, contractor and superintendent of the works, and myself rode to reservoir; saw everything all right; drove about one-half mile, when we were overtaken by a man who informed us that the bottom had dropped out of the reservoir, and sure enough it had, or rather a very large section of it, and the water had gone like magic, where to no fellow can tell. The south reservoir is now being used, and the city splendidly supplied. Yesterday they gave an exhibition of fire streams and all worked well. Mr. Fred Fuller, engineer of the company, promises me he will send you a drawing or sketch, showing manner and extent of break, which is about 40 ft. in one direction, and varying in width from 10 to 20 ft. in another direction.

Yours truly, M. T. DAVIDSON,
President Davidson Steam Pump Co.

PERSONAL.

MR. REDD has been appointed County Surveyor of Henrico, Va.

COL. WM. S. KING has filed his bond as Surveyor-General of the second district of Minnesota.

FIRST-LIEUT. W. F. ROSSELL, Corps of Engineers, is ordered from Jacksonville, Fla., to Forts Clinch and Marian, Fla.

MR. WILBUR F. LEARNED has been appointed resident engineer at Basin No. 4 (Ashland), by the Boston Water Board.

DR. DOMOS C. DE MERVES, Superintendent of Hydraulic and Sanitary Engineering at San Paulo, Brazil, has arrived in New York.

PRESIDENT JULIUS H. SEELYE is to discuss "Dynamite as a Factor in Civilization," in the July number of the *North American Review*.

FIRST-LIEUT. THOS. N. BAILEY, Corps of Engineers, is to proceed from Charleston, S. C., to Forts Jackson and Pulaski, Ga., on public business.

THE trustees of the village of Geneva, N. Y., have requested J. J. R. CROES, C. E., to prepare a plan for the sanitary drainage and sewerage of the village.

MR. SAMUEL H. DOTY has been appointed chief engineer of the Chicago & Atlantic Railroad in place of J. C. WILLIAMS, who has been promoted to General Superintendent.

COL. W. H. PAINE, of the Brooklyn bridge, is claimed for its own by Sheboygan, Wis. Col. Paine was reared in Sheboygan, and began life as a surveyor in North Wisconsin.

GEORGE H. PIERSON, Engineer of the Milton (Pa.) Water-works, advertised elsewhere this week, has also secured the franchises for water-works at Sunbury and Lykens, Pa., which works will be erected at once.

FREDERICK FIFIELD, a surveyor who was lost in the woods, near Ashland, Wis., reached camp again on June 4, having been without food and exposed to a storm for three days. He was exhausted, but will recover.

MR. JOHN A. PARTRIDGE, Mem. Am. Soc. C. E., division engineer at Syracuse, of the N. Y., W. S. & B. Ry., was on the 2d inst. presented with a valuable gold watch as a token of the esteem of his corps, and their regret that he has found it necessary, for personal reasons, to retire. Mr. PARTRIDGE located about one-third of the entire line and leaves well-matured plans for the completion of most of the work west of Syracuse, which is now well advanced.

THE WILL OF AMASA STONE, which excited some curiosity, has been made public. Mr. STONE sets apart for his wife the homestead and $500,000. He bequeaths to his daughters, Mrs. JOHN HAY and Mrs. SAMUEL MATTLES $600,000 each, and to their husbands, $100,000 each; to eighteen nephews and nieces, $5,000 each; to Adelbert College, "if the estate reaches $3,000,000," $100,000; to the Home for Aged Women, $10,000; to the Children's Aid Society, $10,000. The residue of his estate goes to his daughters and their husbands.

COURTLANDT PALMER DIXON, a contractor for materials for government buildings, died in Brooklyn on Tuesday. Mr. DIXON was born in Westerley, R. I., in 1818. His father was United States Senator, NATHAN F. DIXON, of that State. At the age of 16 Mr. DIXON came to New York, and for a number of years was connected with the hardware house of his uncle, COURTLANDT PALMER. Identifying himself with the Dix Island Granite Company, Mr. DIXON secured contracts for furnishing the granite for the United States Treasury building in Washington, the custom-house in Charleston, S. C., and later for the New York post-office.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 257.)

DXXXIX.—ALLIANCE, O.

Alliance, Ohio, is on rolling ground on the Mahoning River. Settled in 1833, and then called Freedom, it was incorporated under its present name in 1875.

Water-works were built in 1883 by a private company by J. A. Cloud, taking the supply from the Mahoning River, which has at this point a water-shed of about 200 square miles.

A dam of squared timber cribs filled in with stone forms a pool, from which the water is taken through a gravel filter and pumped, by two Worthington steam pumps of 1½ million gallons daily capacity, into a stand-pipe 20 ft. in diameter and 80 ft. high.

Distribution is by 5½ miles of cast-iron pipe of 12 to 4 in. diameter, with 51 fire hydrants and 21 gates.

The works have just gone into operation. Service pipes are of wrought iron.

The population is 6,000. The works have cost $110,000.

COLOR MADE BY SOUND.

An optical demonstration of the effect of sound on the colors and figures in soap bubbles was given at the Franklin Institute a few nights ago by Prof. Holman. A film of soap was placed across the end of a phoneidoscope. To bring the sound in direct contact with the soap a tube was used. A reflection of the film was thrown on a canvas screen, where it first assumed a bluish-gray appearance. An intonation of the voice, with the lips close to the mouth of the tube, caused a number of black spots to appear on the reflection. When these passed away a beautiful light green, intermingled with pink, remained. These two appeared to be the principal colors caused by sound. It was noticeable, however, that, while a certain tone would cause the same figure to reappear, it had no control over the color. A tone which, for instance, caused one solid color to appear would bring out, perhaps, a dark blue at one time and a yellow at another. No difference was noticeable in the effect of the male and female voices.

EAST INDIA RAILROADS.

Mr. Conder, a railway magnate of Bombay, was recently interviewed at San Francisco. He said the government owned some 3,000 of the 10,000 miles of way. He said further: "The chief item in our expenses is engineering, and in India we have the finest specimens of engineering in the world. To reduce the expenses narrow gauge was first introduced, but I do not think that it is saving in the end. We shall soon have nothing but all steel rail routes. Railroading is but in its infancy in India, but it has a glorious era in store."

NEWS OF THE WEEK.

PHILADELPHIA WATER-WORKS.—The engines required for the Philadelphia water-works were a 10,000,000 gallon pumping engine for the Frankford works, two 15,000,000 gallon engines for the Spring Garden station and one of 7,500,000 gallon capacity for Roxborough. The sub-committee on the water-works extension opened the bids on Monday but not being satisfactory it was agreed to re-advertise the proposals for the Frankford works engine. The bids for the Spring Garden works were next considered. The proposals for Worthington engines were made by the Southwark Company, of Philadelphia, at $88,950, to be finished in seven months, and by the Worthington Company, of New York, at $81,000, the engines to be completed in seven and nine months. The contract was awarded to the Southwark Company. The contract for the engine for the Roxborough works was awarded to Henry R. Worthington, of New York, at $36,000. Mr. Clay called the attention of the chair to an act of Assembly requiring that contracts should be awarded to the lowest responsible bidder, in view of which he moved the reconsideration of the contract awarded to the Southwark Company. After a general debate as to the expediency of the reconsideration and a discussion of the act of Assembly, the contract was withdrawn from the former company, to whom it had been awarded, and given to H. R. Worthington, of New York. The further consideration of the proposed new reservoir at Thirtieth and Cambria streets was referred to a sub-committee.

MILITARY ROAD-MAKING IN DAKOTA.—The Secretary of War has approved the plans submitted by Lieut. Taber, chief engineer, department of Dakota, for the improvement of the military road between Yankton and Fort Randall, Dak., and Gen. Terry has directed that the work be pushed forward as rapidly as possible. Lieut. Ritzius is now getting out the timber for bridging small streams, and in leveling up the road. The greater portion of the appropriation will be expended in the construction of a bridge over Choteau Creek, for which the plans and specifications are now ready. Advertisements inviting proposals will be made in a few days, and it is expected that the work will be completed by the 1st of October next.

THE AUSTIN & NORTHWESTERN narrow gauge has taken a mortgage of $250,000. It is thought the line will be extended.

THE AUSTIN WATER-WORKS are finished to the Lunatic Asylum, and a test is to be made.

THE CITIZENS OF CLEBURNE (Texas) are moving to have a railroad built from their place to Waxahachie.

THE BRIDGE OVER TRINITY RIVER Dallas (Texas) is being repaired by R. F. Davis.

THE RIVER AND HARBOR IMPROVEMENTS AT VICKSBURG are progressing rapidly. A dispatch says: "Gen. C. B. Comstock, president; Major B. Harrod and Capt. C. Sears, of the Mississippi River Commission, and Capt. W. L. Marshall, United States Engineer, have arrived here. They made an inspection of Plum Point and Providence Reach, and the work done at Delta by the Commission. Gen. Comstock was most favorably impressed with the work at Providence Reach, and was satisfied that it is a perfect success. Some changes have been made in the channel, as predicted by Capt. Marshall. Careful inspection of the revetment at Delta Point showed that not the slightest portion has given way. The dredging work in progress in Vicksburg harbor was inspected. The opinion is that the plan of making deep water will eventually prove successful.

BIDS AND CONTRACTS.—Bids for lighting the new court-house, Chicago, with electricity have been received by the County Board as follows: The Western Edison Electric Light Company, $33,039; the Fuller Electric Light Company, $30,125. The bids have been referred. The contract for putting up the building of the new water-works at Flint, Mich., has been let to Messrs. Maxted & Newcombe, of Manistee. The well is being rapidly sunk, and the foundations for the building have been laid. Bids have been received for an iron roof on the North Side pumping-works Chicago, Ill., as follows: Detroit Bridge and Iron Company, $34,570; Lassig & Alden, $35,400; H. A. Streeter, $32,722; Rust & Coolidge,, $34,762. The contract for the erection of seven electric light towers at Elgin, Ill., has been closed by the City Council.

LAKE VIEW SEWERS.—At a meeting of the citizens and the Town Board of Lake View, Ill., to discuss the situation in reference to the sewers, recently, it was decided to construct a new sewer from High street to Clark street, at a cost of $44,000.

THE RAILROAD BRIDGE over the Colorado River, at the Needles, is 1,700 feet in length.

THE GULF, COLORADO & SANTA FE RAILROAD COMPANY will, it is thought, extend their road 400 or 500 miles.

WORK UPON THE DEVIL'S LAKE branch of the Manitoba is progressing rapidly, and the graders are expected to reach the lake by the first of July. Government surveyors are at work in Ramsey County, and during the present summer will complete their survey as far as range 68, town 156 north. This includes the whole of Ramsey County.

T. MELLON & SONS, bankers, of Pittsburgh, Pa., are offering a job lot of cast-iron water and gas pipe, manufactured by James Marshall & Co., and left on their hands in the recent failure of that firm. There is probably a bargain in it to some contractor.

ALLEGHENY (PA.) WATER-WORKS.—The city of Allegheny, Pa., is advertising for 3 four million and 2 six million gallon pumping engines, to June 25.

NEW WATER-WORKS.—Milton, Sunbury and Lykens are erecting new water-works. Geo. H. Pierson, engineer.

DETROIT CONTRACT PRICES.—Proposals for furnishing the city with sewer pipe, cedar paving blocks and laying stone sidewalks during the fiscal year ending June 30, 1884, were opened by the commissioners of public works on the 4th as follows:

Sewer Pipe.—Robinson & Klugh, 60 off regular prices; Batchelder & Long, 50 off; Portland Cement Sewer Pipe Company, 66 off; E. W. Cary 75 off, and Alex. McKay 53 off.

Paving Blocks.—Mark Flanagan, $8.90 per cord; Ledbeter & Stewart, $10.47 per cord; Eugene Robinson, $10.40 per cord.

Stone Sidewalks.—Batchelder & Long, 24¼ cents per square foot; J. C. Cobb, 26 cents per square foot, for city sidewalks and intersections, and Batchelder & Long 29 cents per square foot for the former, and J. C. Cobb 27 cents for private walks.

A Comparison.—The price of cedar blocks is the same as last year; sewer pipe is three cents per foot higher, and sidewalk bids two and a quarter cents per foot lower on city work and three cents on private work.

THE NEW YORK, WEST SHORE & BUFFALO line was opened this week as far as Newburg, with a branch running to Middletown to connect with the New York, Ontario & Western, which will use the line from Cornwall to Middletown and along the river to Weehawken. There will be storage at Weehawken for 8,000 cars. Trains will run to Kingston in a few weeks and to Albany and Syracuse by end of July. The length of the road from Weehawken to Buffalo is 425 miles.

THE DISCHARGE OF RAILROAD MECHANICS is something usual every summer; this season the proportion will doubtless be larger than usual. The Chicago, Mil. & St. Paul lately discharged 200 men from its Milwaukee shops.

NEW RESERVOIR FOR BANGOR (ME.)—The Water Board recommends the construction of a $25,000 reservoir.

THE CONTRACT FOR THE AUSTIN (TEX.) BRIDGE.—The bridge committee made a contract on June 1 with the King Bridge Co, of Cleveland, O., to build a wrought iron, doubled intersection, high-truss bridge across the Colorado River upon the stone piers of the old bridge. It is to be 910 feet long, 18 feet roadway, at a cost of $45,000, to be completed December 1 next. The contract was made with the Houston agent of the company, who also made a contract with the city for an iron bridge over Waller Creek. The Colorado bridge will have five spans, 150 feet each, and one of 160 feet, and will be solid and safe for the county to buy and make free to the public.

THE NEW WATER COMPANY.—The Colorado Water Company of Colorado (Texas) has been incorporated with a capital of $110,000.

NEW BRIDGE IN PENNSYLVANIA.—A new iron bridge is to be built over the West Branch at Cherrytree, Indiana County. A bridge 43 ft. above water level and 143 ft. in length is being built by the Pennsylvania, Slatington & New England Railroad Company over the Lehigh River.

THE DISCOVERY OF THE BARILOCHI PASS between Chili and the Argentine Republic is likely to have important results, as it will permit the construction of a railroad over a short and easy route, connecting Chili and the Argentine country. It only needs such a railroad to develop the great resources of a large section of South America which has hitherto been almost inaccessible. The existence of the pass was long known to the Indians, but they guarded their secret with jealous care intuitively understanding that it would prove a temptation to the Chilians and Argentines to intrude upon them.

THE KNOXVILLE & OHIO RAILROAD tunnel is now finished. It cost $140,000, and was two years in progress.

BRIMSTONE SHOWERS are spoken of in ancient writ, but it is popularly supposed to belong to the nether regions. However, a shower of it fell recently on a Western farm. A match applied to it caused a blue flame, from which came the odor emitted by burning sulphur. The same substance was also discovered at other points. No satisfactory explanation has yet been given.

THE ST. PAUL (MINN.) PAVEMENTS are anything but satisfactory, and Mr. Palmer, the contractor, has stopped work, owing to his being unable, as he says, to please the engineer. The latter, however, is supported by the Board of Public Works, and the contractor's bondsmen will be called upon.

THE RAMAPO WATER SCHEME.—At a meeting of the New Jersey State Water Commission, held on Monday, it was determined to take legal action to prevent any diversion of the water of the river. The proposed diversion of 50,000,000 gallons daily would injure the individuals now using the water of the Ramapo for manufacturing purposes. The commission also directed L. B. Ward, the hydraulic engineer, to proceed with a survey of the sources of water supply and collate data to be submitted to the Legislature.

OLEAN (N. Y.) WATER BONDS.—The voters of Olean are trying to raise $80,000 for water purposes and bonds to that amount, bearing 4½ per cent., have been placed on the market.

WATER-WORKS SUPPLIES.—The water commissioners of Holyoke (Mass.) have ordered about 11,000 ft. of iron pipe, 7,000 ft. being 12 in. and 2,000 each of 4 and 6 in.

LOWELL (IND.) WANTS A WATER-WORKS, and a draft of a bill has been made authorizing the council to issue bonds for $30,000.

PETERSBURG (VA.) IS TO HAVE A CITY ENGINEER in future. The salary is fixed at $1,200 per annum. Applicants are to be examined by a board of three engineers. In reference to the position a letter from Petersburg in the Richmond *Dispatch* says: "It is reported that several gentlemen from different portions of the State have made application for the position of City Engineer, which office will probably be created by the City Council tomorrow afternoon. The salary is to be a good one, in order to secure the services of a good man. The applicants must be residents of the State and must pass a satisfactory examination.

CORSICANA (TEXAS) is to have a street railroad five miles in length.

AN EFFORT is being made to build a road through the Neuces Valley (Texas). The surveyors will start out on the 1st of June, and it is thought that the route will cross the Neuces River, ten miles above Corpus, near Sharpsburg, and intersect the International & Great Northern at Pearsall, thence up the Neuces Valley and intersect the Sunset road at Uvalde.

THE BOY AND THE DYNAMITE CARTRIDGE.—A Philadelphia boy found a dynamite cartridge lately. While at school he took out his prize and scratched it with his pen. A loud report followed, and so did two fingers and the thumb of the boy's left hand.

ANN ARBOR (MICH.) WATER-WORKS.—A meeting of citizens to decide on the building of water-works will be held on June 11. The city is authorized to issue $75,000 worth of bonds.

HOLLIDAYSBURG (PA.) is to be provided with water-works. The town council has purchased the necessary property.

PRICE OF LAND IN NEW YORK CITY.—A strip of land only eight inches wide and lying between Nos. 9 and 11 Pine street was bought for $5,000 from Alexander Duncan by trustees for John J. Astor.

FAVORITISM AT THE PANAMA CANAL.—Complaints are made of the manner in which contracts have been awarded. Thirty thousand dollars was lately spent in purchasing a town Residence for the chief engineer.

AN EXTENSION OF THE GREAT EASTERN railway, from La Prairie to Rouse's Point, N. Y., is contemplated.

A NEW NOTE BOOK.—Messrs. Keuffel & Esser have published a new transit book for use of the engineer on railroad surveys. Its novelty consists in having printed on the last three leaves of the book (6 pages) all the tables and curve formulæ necessary for the location of a railroad. By the use of these note books the necessity for carrying an engineer's field book of tables will be avoided. The cost is not materially increased, and they will be found very convenient.

THE POND ENGINEERING COMPANY, of St. Louis,

Mo., has been awarded the contract to furnish the pumping machinery for the Rich Hill, Mo., waterworks, consisting of two one-million duplex pumping engines, manufactured by the George F. Blake Manufacturing Co. Boilers to be set with the Jarvis patent furnace, to burn slack coal, with boiler feed pump, heater and pipe connections; works to be in operation about Aug. 1.

SPRINGFIELD (MASS) PUBLIC PARK.—The Mayor has had City Engineer Ellis survey the river front to see who owned the land and what could be best done to improve it. The result is more favorable than would be supposed. Of 1,511 feet of land from Bridge street to a short distance below State, the city and the Southern Railroad own 1,115.

CONTRACT LET.—The contract for building the double track to Greenfield on the River road (Mass.) has been let to George E. Lyons, of Greenfield, who does the masonry work, and W. N. Flynt & Co., of Monson, who do the grading.

BRIDGES AND RAILROAD TRACKS have been considerably damaged by the storm of June 4 in Texas. At Laredo and on the line of the Texas & Mexican Railway, between Laredo and Corpus Christi, the storm was quite severe. At Benavides station, ninety miles from Laredo, four bridges over dry streams and a half a mile of track were washed completely away.

BISMARCK (DAK.) is to have a capitol and a penitentiary at once.

THERE IS BUT ONE NICKEL MINE in the United States now in operation. It is situated in Lancaster County, Pennsylvania. It is two hundred feet deep, and has been worked seventeen years. The demand for this metal is rapidly increasing. Croppings of nickel are found also in Madison, Iowa and Wayne counties, Missouri. The refined metal is worth $3 a pound.

WHILE SURVEYING THE ROUTE of the York & Dillsburg Railroad (Pa.) recently, a civil engineer discovered that on the property of Jacob Moore a sound like low thunder is produced every time a wagon passes over a small hill. E. G. Dyke, chief engineer of the new road, is of the opinion that the hill stands over a large cave. An excavation will be made in the hillside when the road is graded.

THE ELLENDALE EAST & WEST RAILROAD Company, organized by citizens of Dickey County, Dak., to build a road from the Missouri River east through Emmons, Logan, Dickey, Sargent and Richland counties, decided to push forward its work at once, and a corps of surveyors will start east from Ellendale, upon the permanent survey to the James River at Hudson, a newly located town.

B. F. BUSH, Chief Engineer of the projected Toledo, Indianapolis & St. Louis road, was lately in Indianapolis. He believes that the road will be built.

THE GOVERNMENT OF THE UNITED STATES OF COLOMBIA has granted John May, a civil engineer, $3,000 to proceed to the United Sates and endeavor to interest capitalists in the vast coal deposits on the Rio Hacha.

WINFIELD (KANSAS) WATER-WORKS.—The Winfield Water Co. let their contract for iron pipe to Shickle, Harrison & Co., St. Louis; hydrants and valves, Jas. Flower & Bros., Detroit; pumping machinery, Henry R. Worthington, New York. Frank Barclay, C. E., Supt. of construction.

PANAMA WATER-WORKS.—The certificate of the following corporation was filed May 29, at Albany, N. Y.: Panama Water-Works Company, limited, formed to sell, furnish and supply water for any and all purposes to the city and State of Panama, United States of Colombia, to construct waterworks, reservoirs and aqueducts, and also to manufacture and sell ice. Capital stock, $500,000.

THE AMERICAN INSTITUTE OF MINING ENGINEERS were at Lynchburg (Va.) this week. There are about 150 in the party. Soon after arrival the engineers, with a number of prominent citizens, including the mayor, the council and other officials, boarded a special train and went on an excursion to Riverville, Stapleton and other mines on the James River. They have since visited Roanoke and Blue Ridge Springs.

THE SUNSET ROUTE.—Parties from the front say the Mexican extension of the Sunset Route is being rapidly pushed on. The track has been completed to the Sabinal River, a distance of seventy miles. Trains are running regularly, and the bridge will soon be finished. W. N. Monroe is pushing the grading rapidly. Two-thirds of the working men are Mexicans. They pay eighty cents (Mexican money) a day and food—cornbread and bacon.

THE LAREDO (TEXAS) CITY HALL CONTRACT, ETC.—The City Council opened this evening the bids to build the city hall and market house with the following result: W. H. Adams, $37,596.25; W. R. Pace, $43,500; Dupey, Waite & Co., $39,850; Gilliano Garcia, $32,250; S. Sporbert, $43,950; Wm. Thason, $38,500; L. J. Giraud, $37,250. The contract was let to L. J. Giraud.

ROCHESTER WATER SUITS.—The mill-owners on the outlet of Hemlock and Canadian lakes, from which Rochester, N. Y., draws its water supply by works constructed in 1875, began suits against the city in 1879, asking for an injunction to restrain the city from taking the water, claiming that they were entitled to the natural flow and had never been compensated for its diversion. The city claimed that the State owned the lakes, and had given authority to the city to take the water, and the complainants had no rights. The lower courts dismissed the suit, but the Court of Appeals has just reversed this decision and ordered a new trial.

ANN ARBOR (MICH.) WATER-WORKS.—The question of water-works at Ann Arbor, Mich., is being discussed by the citizens of that place. It is proposed to pump water from infiltrating cisterns near the river. It is estimated that the machinery and seventeen miles of pipe, with 104 hydrants sufficient to supply all parts of the city, would cost $115,000.

RAILWAY PROGRESS—THE CANADIAN PACIFIC.—Forty miles of this road will be finished by July 1. This portion runs through Fraser Canon, and is pronounced by engineers the most difficult part of the entire road.

NEW RAILROADS.—The Terre Haute & South Western Railroad Co. has been incorporated at Springfield, Ill. The line is to run from Darwin, Clark County, Ill., in a southwesterly direction to Oblong, in Crawford County, and from thence to Jasper County, and from Newton the line will be extended to Chester. The principal offices will be located at Newton, and the capital is fixed at $1,500,000. ...It is stated that the Crawford syndicate has decided to build the Chicago & Great Southern road into Chicago. It will have the lightest grades of any road coming from the coal mines of Indiana....A contract for a loop line of 18 miles of railroad between Emerson and West Lynne, Winnipeg, has been concluded. The line will be graded and ready for rails by July 1....A party of American and English capitalists are now inspecting the route for a railroad from Hempstead to Velasco, Texas. The road has a charter under the name of the Brazos, Mound City & Northern Railroad. Steps will also be taken toward securing deep water at the mouth of the Brazos, and it is said that the Chicago, Burlington & Quincy road is interested in the project.

THE CAPE COD CANAL BILL has been defeated in the Massachusetts Senate by a vote of 12 to 9.

A BIG CAR CONTRACT.—The Lafayette Car and Wheel Works Company, of Lafayette (Ind.), has closed a contract for making 2,000 cars for a New York City railway company.

THE NORTHERN PACIFIC is to have a subsidy of $150,000 to build a road 40 miles to the coal fields of Kings Co. (W. T.)

LAYING THE SOUTH CHICAGO WATER MAIN has been suspended on account of the lack of funds. The original assessment for the work was $64,000, of which amount over $9,000 was contested successfully, leaving about $54,000 to do the work with. The pipe cost about $46,000, and the remainder has been paid to the contractors for laying. When the appropriation bill is passed some provision will be made for this work.

AUSTIN'S (TEXAS) BROKEN BRIDGE.—The Bridge Company Directory has had two meetings, and conferred with the contractor. The rest of the bridge has been pronounced unsafe, and inquiries are now making as to the cost of an iron one.

THE LAREDO (TEXAS) GAS WORKS.—The city gas works are to be immediately begun. The contractor is Mr. Foster, of Austin, and he estimates the cost of the plant at over $75,000.

THE ENGINEERS surveying the Virginia and North Carolina Railroad, from Mecklensburg *via* Petersburg, have nearly reached Richmond. Another party under Chief Engineer Burgwynne has surveyed the route through the city.

A PETITION FOR THE REMOVAL OF THE GAS WORKS has been presented to the Board of Health by citizens of Wakefield (Mass). The works also supply Stoneham and Reading with gas. The hearing was held June 7.

THE LYNN (MASS.) WATER-WORKS basins contain 180,000,000 gallons at present.

HAMILTON WATER-WORKS CONTRACT.—The contract for furnishing water pipe and bedrock castings for the new works at Hamilton, Ohio, has been secured by the Cincinnati & Newport Iron and Pipe Co.

SALE OF A MONTANA MINE.—It is stated that A. J. Davis, who lately bought the Silver Bow mining property for $100,000, has sold it to a French company for $3,000,000.

ALKALINE WATER is credited with causing many deaths in districts of Indiana, etc.

AN EXCURSION OF MINING ENGINEERS, professors and students of the Massachusetts Institute of Technology, has left Boston for the mining regions of Virginia. The party will attend the summer meeting of the American Institute of Mining Engineers, which commences at Roanoke, Va., on June 5, after which it will organize for active work, principally in the valley of the New River, making headquarters at Roanoke. Recent geological surveys made in that locality show extensive deposits of valuable minerals. A railroad has been projected by New York capitalists through this valley to this new mining region.

CONTRACTS FOR THE HARRISBURG WESTERN will be let out before July 1, and ten thousand men set to work to complete the line.

A CONTRACTOR'S DAMAGES AGAINST BOSTON.—The referees in the suit of William Polland and others, contractors, against the City of Boston, to recover $600,000 damages alleged to have been sustained by plaintiffs by failure of the city to carry out its contract with them in building a sewer at Dorchester Bay, have awarded plaintiffs $66,000, of which $36,000 was a reserve which the city withheld on payments under contract.

THE PATERSON WATER COMPANY and other interests which lease the bulk of the Passaic River flow to the Paterson mills, are viewing with some alarm the proposal to use the water of the Ramapo for New York purposes.

THE BUDGET OF THE JERSEY CITY BOARD OF PUBLIC WORKS for the fiscal year is $161,500.

THE IRON AND METAL MARKET.

PHILADELPHIA, JUNE 7.

No further improvement is to be noted in the eastern Pennsylvania iron market; prices are weak, and, in crude iron, declining. The impetus received three weeks ago will continue to act, notwithstanding the announcement of a general resumption of iron making. The demand for finished iron and nails is quite active in a retail way, though very little business is being done for July. Inquiries for bridge iron and boiler plates, are more numerous, and several orders, aggregating 600 or 700 tons, have been placed, and there are other inquiries on the market.

Sheet iron is more active, several good orders for tubes and pipes have been secured, and a number of small orders for steel rails were booked at $39. Merchant bar is 2.20c; nails, $3.10. Standard brands of pig iron are selling at from $19 to $22 for Foundry, and $18 at furnace for Forge. A good deal of business has been done within a few days in pig at low prices. A very healthy condition of business is reported from the bridge works, locomotive works, car shops and ship yards, where the strike has not prevailed.

PITTSBURGH.

Pig iron has already improved under the announcement of a resumption. Consumers will not load up with raw material, but prices have stiffened. Forge irons are $17.50@$18.50; Sundry, $19@$21; Muck Bars, $34@$34.50. Manufactured iron will decline in price because consumers have been stocking up for several weeks past, in view of a strike. Two or three large sales of American Ts were sold for summer delivery at $21.30. Steel rail orders are coming in slowly, and prices are firm at $39@$40. Mills have about three months' orders on hand. Nails have been bought very freely, and are expected to weaken. Merchant steel is dull. Crop ends, $25. Scrap unchanged.

CHICAGO.

The announcement of signing the scale by the Pittsburgh manufacturers, took the Northwest by surprise, as arrangements were made in many cases to continue operations, wages to be subjected to the Pittsburgh settlement. Consumers are pretty well stocked with from four to six weeks' supplies and it is regarded as not improbable in iron circles that a weakness may be developed. Merchant steel, nails, structural iron, bridge plate and sheet iron are all firmer than three weeks ago.

Steel rails are in active demand, and Western mills are well sold up. Requirements from agricultural implement works are slacking up. Pig iron is weak and dull. No marked change is anticipated for the present. The probabilities are that the over-producing capacity will result in a weakness in a short time.